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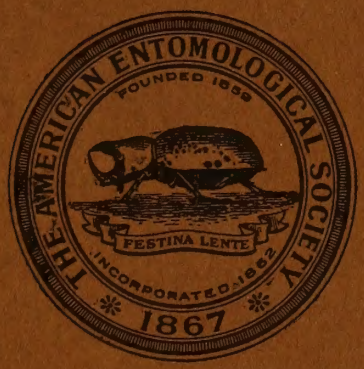
(DIPTERA: TRYPETIDAE)

BY

VENIA TARRIS PHILLIPS



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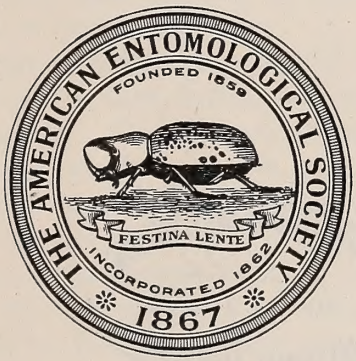

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THE BIOLOGY AND IDENTIFICATION OF TRYPETID LARVAE (DIPTERA: TRYPETIDAE) [1]

By Venia Tarris Phillips

The Academy of Natural Sciences of Philadelphia

A peculiar need has long been felt for exact descriptions and accurate keys which could be used in identifying larvae of this family. Many of the species included here are important pests of fruits and vegetables, while others of similar habits may be introduced at any time, entering our ports with fresh fruit from abroad. Knowing this, it is unnecessary to comment upon the value of any means which will assist in the recognition of such larvae.

The author has freely consulted the published works listed in the "References" and particularly those dealing with morphological structures of acalyptrate maggots. The few works which deal with groups of larvae, and attempt any sort of comparison, were particularly useful.

The first comparative paper of interest was written by Nathan Banks in 1912, "The Structure of Certain Dipterous Larvae, with Particular Reference to Those in Human Foods." Although the information about trypetids which it contains is decidedly meagre, nevertheless, it prepared the way for further studies of this nature.

In 1929 Charles T. Greene published his "Characters of the Larvae and Pupae of Certain Fruit Flies." His particular contributions to the present work were found in his use of gross structural characters, and in his attached glossary.

[1] Prepared as partial fulfilment for Ph.D. at Cornell University, June 1938.

Later, in 1934, Foster H. Benjamin greatly enlarged upon the knowledge of the larvae in his paper, "Descriptions of Some Native Trypetid Flies." This work, while perhaps dealing primarily with adult forms, nevertheless, adds detailed descriptions of many larvae. As an addition to the knowledge of the biology of species, Benjamin's paper was even more useful.

In none of the foregoing works, however, were microscopical morphological characters used, which in the opinion of the author are the only ones which can give dependable identifications. Such characters were first used by H. C. Efflatoun, in 1927, in his paper, "On the Morphology of Some Egyptian Trypaneid Larvae." Here, for the first time, stress was laid on the type and position of the interspiracular processes. The structure of the cephalo-pharyngeal skeleton of each species was also figured, as well as the group of sense organs found on the anterior end of the body.

Finally, in September 1937, G. C. Varley's paper appeared with detailed descriptions and figures of several European species belonging to the two genera *Euribia* and *Trypeta*. This paper contains keys for larval identifcation as well as excellent figures portraying the morphology of the parts used for determination.

In the present paper the same general plan is followed as that used by Efflatoun, and similar morphological characters are employed for identification. The author has attempted to go a step further and has included keys for recognition purposes.

Many individual works have been published in the past which included a description of a single species of fruit-fly larva. Such papers have proved extremely useful and due recognition is made for the information gleaned from them.

The author does not try to offer a complete survey of the American species of the family, nor will the keys be all-inclusive. Only the forty-five species described herein can be traced in the keys, but it is hoped that the work will be useful as a pioneer attempt in this field. Only specimens from groups of bred material have been used, so that the identifications should be fairly accurate.[2]

So far as the question of synonymy is concerned, the author does

[2] Identifications of species and host plants are those listed by the donor in all cases except those in which the specimens were collected by the author.

not try to use names based on priority but has generally adopted those established by long usage.

Much difference of opinion has been expressed in recent years about the exact relationships and limits of various genera in this family. Also many individual species have been considered synonymous with earlier ones, without always adequate proof to support the opinion. The present paper is bound to throw some light on this matter where such species have been included. When studied with an eye to minute morphological structures of the larval form, some of the contested species have readily dropped into the correct niche in classification. When a larger number of species and genera can be studied, it seems probable that definite generic limits can be outlined in this manner.

On the other hand, a few species cannot be differentiated in the larval stage. Fortunately in most cases, this is true of related species, of which the adults are readily distinguishable.

The feeding needs of various members of the Trypetidae are manifold, and every part of the plant structure seems to suffer from depredations of fruit-fly larvae. Roots, stems, leaves, flowers, fruits and seeds, all may be attacked by members of the family. Aside from the fact that the parts may be actually devoured, many galls are formed because of the presence of trypetid maggots.

Root-galls which have been caused by the development of fruit-fly larvae, are found on many species of Compositae. *Eurosta comma* Wiedemann, produces large galls on *Solidago altissima,* Nuttall, but the galls seem to do little harm to the plant, as it continues to appear sturdy and healthy.

Stems may be injured either by the larvae tunneling directly into the pulp, or by the presence of galls. *Straussia longipennis* Wiedemann, may live in the stem of the sunflower and Jerusalem artichoke, while the goldenrod gall fly (*Eurosta solidaginis* Fitch) causes galls to appear, enlarging the stem to a globular malformation which is very conspicuous.

Various species mine in leaves, living the entire immature life between the epidermal layers, even pupating there upon occasion. *Acidia fratria* Loew, often becomes a serious pest of celery and parsnip, destroying the leaves.

As the name "fruit-fly" suggests, the commonest type of injury is that suffered by the fruits of certain plants. Blueberries, apples and cherries are subject to depleted and ruined crops as a result of infestation by fruit-fly larvae. In these fruits the larvae feed upon the pulp, sometimes tunneling through it and eventually reducing the whole to a juicy inedible mass.

Lastly, the seeds themselves make very acceptable food to many species. Doubtless the weed seeds are most often infested but one species, at least, *Epochra canadensis* Loew, devours the seeds of an edible fruit, thereby making the currant and gooseberry crops worthless for marketing purposes.

The question of fruit-fly biology will be discussed under the individual specific heading. Suffice it to say that all injury is done by the larvae, and that most species show a marked tendency to adopt a single host and will refuse all others. Such species are fairly easily controlled. Others, however, such as the Mediterranean Fruit-fly, are general feeders. The latter (*Ceratitis capitata* Wiedemann) eats practically any kind of fruit and consequently is considered a most serious pest wherever abundant. Fortunately, it finds winters in this country a bit cold for its survival.

The host plant list appended is far from complete, but is included for reference purposes since it is more extensive than any so far published. Often, too, knowing the plant in which a species is found, the worker can identify the larvae without further effort. Many species of plants listed are entirely unknown in this part of the country but the knowledge of the name of kinds likely to be attacked, may aid in preventing their accidental introduction into the United States. Also, knowledge of the hosts in one country, often aids in correctly prophesying those which are most likely to be infested in a new country.

In the list of insects with known hosts, the plant names are copied as written in the original paper. In the alphabetical list of plants, however, some attempt is made to refer them to their proper scientific names. Bailey's "Cyclopaedia of Horticulture" was used for cultivated plants, the Kew Index for exotics, while Gray's "New Manual of Botany" and Small's "Manual of the Southeastern Flora" were freely consulted for native wild species.

Acknowledgments

Many persons have aided the writer throughout the course of this work. Thanks are especially due to O. A. Johannsen, under whose direction the study was made. Numerous suggestions and helpful criticisms have been offered by him and many specimens supplied from his personal collection. Several species have been lent by C. F. W. Muesebeck from the material in the United States National Museum. F. S. Blanton has generously donated a large number of larvae, which were taken by him in the eastern United States. The western material was the gift of S. C. Jones and has increased the number of species considerably. Indeed, but for the specimens from these sources, the work could never have been attempted. Many other entomologists have liberally contributed material and due credit has been given to them in the descriptions of the species involved. K. M. Wiegand gave helpful suggestions and criticisms in the preparation of the host plant list. Lastly, M. E. Phillips aided the author in the preparation of the plates. The writer wishes to extend her sincere thanks to all of those who have assisted in the study.

Preparation of larval skins for study

The first preparations were mounted in Canada balsam, but some little difficulty was encountered in handling this medium successfully. The minute structure was very difficult to see and the whole quite unsatisfactory.

Later mounts were made in Euparal. Then, with the addition of stain, slides were prepared which displayed the skins quite adequately. If mounted specimens lose their color with age, the Euparal may be readily soaked off in alcohol and the material restained and mounted again.

The slides used in this study were prepared as follows: each specimen was cut with fine scissors to sever partially a transverse slice from the dorsal side, near the caudal end. This slit eventually acted as a guide to the removal of the entire last segment so that it could be mounted separately. Naturally, the cut should not extend more than two-thirds through the body. There were two reasons for making this slit, first to give the caustic potash easier entrance to the soft inner parts, and second to aid in the technique of mounting the caudal segment for

special study. Since this section was left attached to the whole skin, the author was enabled to run several larvae through the various processes at one time, in a single preparation dish. It proved desirable also to make a small dorsal slit in the thoracic region for ease in later handling. The specimens were then placed in ten per cent KOH and left over night.

The next morning a specimen was removed from the KOH and placed in a large drop of water on a microscope slide. By holding the cephalic end against the slide with a pair of forceps, it was possible to roll a needle carefully along the body from head backward and so remove the entire soft parts by squeezing them out through the posterior cut. The larval skin was then washed a few times in water and placed in a dish of clean water and left there about as long as it was left in the KOH, although a shorter period seemed sufficient when time was pressing.

Water was removed from the preparation dish in which the larval skins were soaking, by means of a small medicine dropper, then a few cc. of Ziehl's carbol-fuchsin stain were added. The length of time specimens should remain in the stain was determined by the size of the individual, because the larger ones absorbed the stain faster than the smaller. Mounts which were too heavily stained were difficult to study. Some of the smaller species were left over night in Ziehl's carbol-fuchsin without harm, while others were found to be sufficiently stained in an hour.

The material was washed in thirty per cent alcohol and then run through higher strengths, the skins left in each for about an hour. It was found better to omit the use of absolute alcohol, since it hardened the material too much for easy manipulation.

Each larval skin was next mounted in Euparal. First, the specimen was placed as desired on the slide. Then with a sharp scalpel, the caudal slice was severed from the body. The small caudal piece was mounted on the same slide under the same cover glass, close to the bulkier piece. Before the cover glass was placed over the mount, it was found necessary to arrange the skin in the best position for showing all important structures. The external parts of the anterior respiratory organs were carefully spread out and the caudal slice placed with the external surface upward so that the posterior stigmata could be readily observed. This latter precaution was very important.

General description

Usually the larvae of this family of flies are small in size and yellowish-white in color. A minute black dot shows on each side of the anterior and smaller end. These black dots represent the mouth hooks which are so heavily sclerotized as to appear black where they stick out of the mouth. The maggots average from 7 to 9 mm. in length. However, some species are much larger, being 15 mm. long while at the other end of the scale some very small ones are found, which measure only 3 mm. All measurements apply to mature larvae and are taken from preserved specimens rather than from living ones.

In species which live in varied host plants, the individual specimens differ somewhat in size according to the kind of food eaten. *Rhagoletis pomonella* (Walsh) reared from *Crataegus* is noticeably smaller than the same species bred from the apple. At the same time there is a remarkable variation in size of individuals even when taken from the same apple, apparently exposed to the same living conditions, and certainly having a similar food supply. During the larval stage most of the members of the family live actually surrounded by their food and consequently differences in size can scarcely be due to any lack in this respect.

In shape the larvae are generally elongate, with the head region tapered, while the posterior end is rather sharply truncated. The lateral view of the entire larva of *Trypeta florescentiae* Linnaeus (Pl. VIII, fig. 91) shows this typical form plainly. Species which live in juicy fruits are generally of this shape.

A few larvae are short and stout in contrast to the above and are rather suddenly narrowed at each end, giving a barrel-shaped outline (Pl. VIII, fig. 92). This form is found in some species which dwell in dry situations, usually living in galls on the stems, roots, etc.

According to Snodgrass (1924, p. 1), the larva is composed of the reduced head, three thoracic segments and eight abdominal segments. The segment near the anterior end which bears the anterior respiratory organs is the first thoracic segment. The entire region in front of this is included in the head. While only eight abdominal segments are found, the last division actually includes the eighth, ninth and tenth combined.

Living as they do, completely surrounded by food, locomotion becomes of minor importance to these insects during most of their immature existence. They have small need for traveling in search of food and must only move along the tunnel a short distance to obtain a fresh supply. Furthermore, locomotion to escape enemies is not essential because they are admirably protected by their surroundings.

The larvae eat their way through the food, leaving tunnels behind them, into which their bodies fit closely. Locomotion is reduced to a series of squirming movements which shoves the larvae forward. However, in order to accomplish this, some leverage of the body is necessary. When anchorage is supplied, the body fluids are rhythmically pushed forward and the caudal end drawn up, thus helping in a general progression of the entire larvae.

This leverage is accomplished by attaching the body more or less securely in the tunnel by means of small spinules which lie in the outer surface of the integument. These are simple, conical processes, sometimes curved at the tips, but often straight throughout and awl-shaped. Some of these spinules are directed forward, others backward, and because of this, locomotion may be accomplished in either direction at will.

The areas bearing spinules are usually confined to regions lying along each side of the divisions between the segments. In some species, bands of such spinules may completely encircle the body, although they are always more numerous on the ventral side. The spinulose areas are not always uniformly covered with spines, but often bear many small groups arranged in curved lines, the whole more or less resembling the conventional cartographic representation of mountains. Certain species bear spinules only on limited areas around the venter. In such cases, the spinulose regions are spindle-shaped and hence called fusiform areas. Although mostly confined to the venter, these fusiform areas may extend laterally, perhaps halfway up the sides of the larva.

A large number of trypetids leave their hosts and enter the ground for pupation. This habit necessitates another type of locomotion, for a brief period in their existence. Often they fall to the ground where entrance into the earth is impossible. Then the larvae must move around and locate suitable entrances or die. This traveling is accomplished in many species by a series of quick jerks. Such motions

pull the two ends of the body together and release them suddenly, causing the insect to spring off a short distance. Quick repetitions of this performance result in surprisingly fast progress.

Sometimes larvae are seen to move along as though walking, using their spinules to give leverage and progressing as though on stilts. On a rough, uneven surface, the larva travels fairly fast in this manner.

The exoskeleton of the body is usually smooth but may be wrinkled or even provided with minute granules or tubercles. Spinules, other than those used in locomotion may be found in some regions. This is particularly true of the posterior end of the eighth abdominal segment where they may be seen scattered about over a large part of the area. Occasionally dark markings may be seen on the body but these are so unusual in the family, that their presence is an excellent specific character. Rarely, if ever, are hairs found on trypetid larvae.

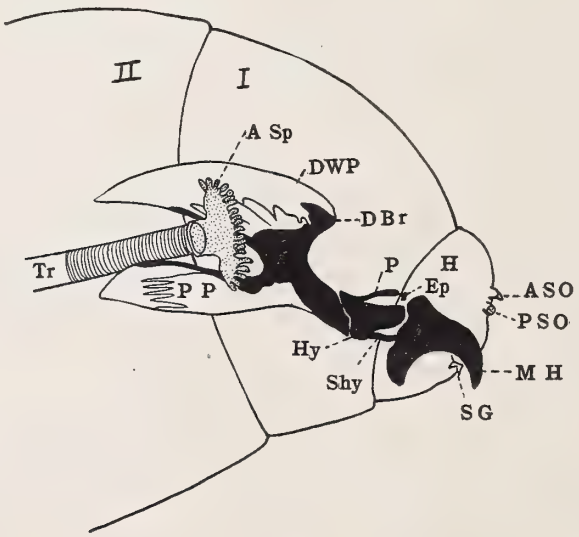
The head is usually trapezoidal in outline and divided into two parts or folds by a transverse constriction. The resulting rings are not true segments, and are only conspicuous when the head is retracted. The head as seen in these larvae, represents only a part of the true head (Snodgrass, 1924, p. 2). This region bears the sensory organs and encloses the mouth and cephalo-pharyngeal skeleton.

Much controversy has taken place in literature regarding the morphological relationships of the sense organs of the larval head. Earlier workers wished to connect these appendages with those found in adults. Consequently the names of "Antennae" and "Maxillary palpi" were often used to designate them. However, Snodgrass (1924, p. 2) refers to the embryological development and shows that these external organs can have no real connection with either antennae or maxillae.

The anterior end of the head is somewhat blunt and bears two pairs of minute sensory papillae, which are fairly conspicuous under the microscope. These are called simply "anterior sense organs" and "posterior sense organs." Each papilla supports sensory end organs.

The anterior sense organs lie closer together than the others, and farther from the mouth. They are minute, short structures, which may be composed of one, two or three segments in different species. In various genera, the number of segments in the anterior sensory organ is constant for the species studied. This is true of *Anastrepha, Dacus, Eurosta, Neaspilota, Rhagoletis* and *Zonosemata.* Variation

of this characteristic occurs, however, in the genus *Trupanea*. *T. abstersa* Loew and *T. subpura* Johnson bear anterior sensory organs of a single segment each, while *T. actinibola* Loew and *T. jonesi* Curran show these organs with two and three segments respectively. This variation in Trupanea would hardly disprove the statement of constancy, since the genus as now outlined, very doubtfully fills the requirements of a genus and many species have been included in it for lack of a better classification.



Text figure 1. I. first thoracic segment; II. second thoracic segment; A. S. O. anterior sense organ; A. sp. anterior respiratory organ; D. Br. dorsal bridge; D. W. P. dorsal wing plate; Ep. epistomium; H. head; Hy. hypostomium; M. H. mouth hook; P. parastomium; P. P. pharyngeal plate; P. S. O. posterior sense organ; S. G. stomal guard; S. Hy. subhypostomium; Tr. trachea.

The posterior sense organs are situated immediately below the anterior ones and are quite different in external form. Usually, each is composed of one segment with its distal surface broadened and flattened and bearing several minute sensoria.

Snodgrass figured (1924, Pl. I, fig. B) the sensory organs for *Rhagoletis pomonella* (Walsh) and Efflatoun (1927) included plates of anterior and posterior sensory organs for eighteen species. Lying

close to the mouth hooks but near their upper lateral edges, another pair of sensory organs may be found. These are the stomal sense papillae.

The mouth is situated in the middle of the lower surface of the head and appears like a slit, the axis of which is dorso-central. From the mouth project the oral hooks. At the base of the mouth orifice and laterad to it the oral lobes are found. These consist of semi-circular flaps which are often furnished with transverse ridges and grooves. The grooves vary in number in different species. They flare out in the shape of a fan and always lead backward into the mouth cavity. Liquid food, flowing through the mouth is doubtless carried through these grooves. Externally, a few chitinous teeth are sometimes found on the oral lobes, which possibly function as guards for the mouth hooks themselves.

In larvae of higher Diptera, the anterior end has been invaginated until the extreme visible tip is more properly called the neck, since the true head lies buried within. In these larvae therefore, the food enters the opening between the mouth hooks, then passes into the oral chamber and thence into the larger cavity, the pharynx.

The cephalo-pharyngeal skeleton is a framework which is heavily sclerotized and darkened. Anteriorly it includes the mouth hooks and continues caudad to surround the mouth cavity and pharynx. The cephalo-pharyngeal skeleton performs three functions. It gives rigidity to the walls of the stomal and pharyngeal cavities. By articulation with the mouth hooks, it offers leverage whereby the muscles may move the hooks up and down in eating. Lastly it gives attachment for muscles controlling the entire feeding process.

The trypetid cephalo-pharyngeal skeleton resembles that of members of the calyptrate muscids described and figured by Thomsen (1935, Pls. V–VIII, figs. 22–31). However, the former appear to lack some of the associated sense organs described by him, as well as a few of the smaller sclerites. Also, in trypetids the two mouth hooks are equally developed.

The mouth hooks extend outside the body of the active maggot and may be seen busily working up and down while the insect feeds, tearing the tissue of the plant apart and releasing its juices. Although called mandibles or mandibular sclerites by many authors, Snodgress (1924,

p. 3) again refers to the embryological development in proving the impossibility of true mandibles appearing on the skeletal parts of trypetid larvae. The juices released by the action of the mouth hooks, pass into the mouth and later are guided through the pharynx by the grooves in the floor, after which they enter the esophagus.

The oral hooks are paired symmetrical structures, each with a curved, heavy tip. Caudally the hook broadens and presents a distinct knob which, for rigidity, fits against the hypostomal piece of the cephalopharyngeal skeleton. Near the middle of the widened base, a single hole or unsclerotized area shows in some preparations. This corresponds to the location of a sense organ in Stomoxydinae, according to Thomsen (1935, p. 540). The mouth hook is solid near the tip but evidently hollow in the basal region where the two edges can be distinctly seen with the clear area inside. Sometimes weak teeth occur along the lower margin of the mouth hook, but in this family there seems to be little variation so far as teeth are concerned. Small irregularities are often present along the lower margin of the hook but these are probably due to the wearing away of the edge in feeding.

The stomal cavity is supported by skeletal parts in its roof, walls and floor. As seen from the lateral view, a heavy piece, sometimes triangular in outline, articulates with the mouth hook in front and with the pharyngeal skeleton posteriorly. However, this so-called "triangular piece" is not a paired structure but a semi-circular one with two lateral pieces, one of which is not seen in side view. These lateral pieces are connected posteriorly by a bar in the floor of the mouth. It was due to this peculiar shape that Keilin (1915, p. 82) named it the H-shaped piece. This designation is descriptive of the dorsal view but not of the lateral aspect. The writer prefers to use the name adopted by Lowne (1890–92, v. I, p. 44), by Efflatoun (1927, p. 21, fig. 3) and by Thomsen (1935, p. 539) for this sclerite, that is the hypostomal piece or hypostomium.

Near the dorso-caudal end of the hypostomal piece there is attached a rather long rod-shaped pair of sclerites which extends forward and lies parallel to the hypostomium. These are the parastomal sclerites which, anteriorly show no evidence of articulation with the skeletal part. Possibly they lend some rigidity to the roof of the mouth. In describing them in the Stomoxydinae, Thomsen (1935, p. 539) states that

they vary in individual specimens, sometimes being either absent or present in the same species. If this is true in trypetids, which the writer is inclined to doubt, parastomal variations can hardly be used in classification.

Somewhat nearer the mouth hooks, lies an unpaired sclerite which is far more important in supporting the roof of the mouth than are the parastomals. This piece almost surely corresponds to the "epistomal sclerite" of Thomsen (1935, p. 539) because, although differing in shape and size, it bears the two pairs of so-called sense organs of that investigator. In the Stomoxydinae this piece appears as a rather heavy shield-shaped structure which is longer than deep while in *Rhagoletis pomonella* (Walsh) it has assumed a bridge-like form, being deeper than long. Snodgrass (1924, Pl. III, fig. c) figures this piece in *Rhagoletis pomonella* (Walsh) as lying imbedded in the roof but without articulation with other parts of the skeleton. The slides of the author show that it sometimes possesses lateral prolongations which are attached to the internal surface of the hypostomal piece, just in front of the parastomals.

"The Anatomy of the Apple Maggot," Snodgrass (1924, Pl. III, fig. c) contains excellent figures of the cephalo-pharyngeal skeleton along with descriptions of the parts. His illustrations adequately portray the skeleton and proved of great help in this study of other trypetid larvae. One structure was not stressed by him, although his figure shows the presence of the part in question. In the floor of the mouth between the crossbar of the hypostomal piece and the mouth hooks, lie two small, elongate sclerites which come together in the shape of a V. The apex lies between the great hooks and each arm articulates with the lateral hypostomal piece. Apparently these structures may help to hold the mouth hooks apart. Judging from the position, they must correspond to the "irregular sclerites' of Thomsen (1935, p. 539) although of somewhat different shape in this family of Diptera. Efflatoun's name of subhypostome (1927, p. 21) is used here to designate this pair of sclerites. In many slides it does not show in lateral view even though clearly visible from the dorsal and ventral aspects. Many other preparations show them as straight rods lying below the anterior part of the hypostome, between the ventral crossbar of the

hypostomal piece and the basal projection of the mouth hook. Since they are so often obscured, it would seem that while handling the specimens in mounting, some muscular spring was released which threw the whole structure upward into the atrial cavity, thus hiding it behind the hypostomium. It seems certain then that these are the sub-hypostomal sclerites of Efflatoun (1927, p. 21, fig. 3) which are described as being sometimes in two pieces. The writer's slides bear out this statement with regard to *Rhagoletis pomonella* (Walsh) since here the cleavage between them is clearly shown. The two arms articulate with each other just between the mouth hooks.

Behind the stomal cavity lies a large chamber, the pharynx. The floor is traversed longitudinally by several ridges which are somewhat sclerotized but not rightly included as a part of the cepohalo-pharyngeal skeleton. These ridges aid in directing liquid food from the mouth to the esophagus.

The side walls of the pharyngeal cavity are greatly strengthened by elongate, dilated pieces, the posterior pharyngeal plates. Extending dorsally from the pharynx proper, near its antero-dorsal corner, is a bladder-like chamber, called the dorsal pouch (Snodgrass, 1924, pp. 9–10). This pouch divides into two lobes which are produced backward, the outer-walls of which are sclerotized and form the two dorsal wing plates. The latter are connected above at the anterior angle by a narrow bridge, which corresponds in position to the "dorsal arch" of Thomsen (1935, p. 538). While in Stomoxydinae this dorsal arch is a distinct sclerite, articulated to the inner surface of the dorsal wing plates, in Trypetidae, it is clearly a bridge connecting the two wings.

In describing the posterior pharyngeal sclerites and the dorsal wings, as defined in this paper, Efflatoun (1927, p. 21, fig. 3) groups them together and calls them the "cephalo-pharyngeal sclerite." He describes it as the largest sclerite of the skeleton and states that it usually possesses four upper and four lower prolongations. This seems hardly to apply to all trypetids, although a few species studied would answer the description perfectly. To be sure, in species which do not possess a distinct cleft, often a more heavily colored and sclerotized prolongation runs along the lower edge of the dorsal wing and another along the upper edge of the posterior pharyngeal sclerite. These heavier prolongations are, however, usually clearly connected with the rest of the sclerite, but by thinner areas and consequently not truly cleft.

Thomsen (1935, Pl. IV, fig. 20) figures a pair of sense organs situated at the posterior end of the posterior pharyngeal plates near the dorsal edge. In checking some eighty-five slides of *Rhagoletis pomonella* (Walsh) no trace of such organs could be found; nor have they been discerned in any of the other preparations studied.

Four sets of muscles are attached to the outside walls of the cephalo-pharyngeal skeleton. Two pairs move the mouth hooks up and down in feeding. The other two pairs are responsible for protracting the skeleton and forcing the mouth hooks foreward, outside the body wall.

While studying the cephalo-pharyngeal skeleton, the author made a real effort to check the literature dealing with the subject. No published accounts could be found wherein results of any comparative studies for different families of acalyptrate Diptera were given. Various workers have featured the minute structures of the skeleton in a single species and others have cited many examples in groups other than Trypetidae. De Meijere's work (1927) on anthomyiids, pictures the skeleton for many species, but includes no keys or summaries of the skeletal characters. Thomsen's paper "A Comparative Study of the Development of the Stomoxydinae" discusses the question very fully for the calyptrates. The latter work has been used as a basis for the present study.

Some entomologists might think that the terms used by Snodgrass should be adhered to in this work since his names may be more familiar to the American reader. However, some exceptions have been made. Thomsen's terms have been adopted in cases where the parts have not hitherto possessed distinctive names. A chart indicating the terms applied to the various parts of the cephalo-pharyngeal skeleton by several investigators, is given below and may aid in the study of the subject.

Author (V.T.Phillips)	Cephalo-pharyngeal skeleton	Mouth hooks	Subhypo-stomium	Hypo-stomium	Para-stomium	Epi-stomium	Dorsal wing plates	Pharyngeal plates
Thomsen (1935)	Mouth skeleton	Mouth hooks	Irregular sclerite	Hypo-stomal sclerite	Para-stomal sclerite	Epi-stomal sclerite	Pharyngeal sclerites	
Hewitt (1914)	Cephalo-pharyngeal skeleton	Mandibular sclerite		Hypo-stomal sclerite			Dorsal lateral pharyngeal sclerites	Ventral lateral pharyngeal sclerites
Keilin (1915)	Armature bucco-pharyngienne	Crochets latéraux	Lévre inferieure	Pièce en H (piece intermediare)			Pièce basilaire	
Wahl (1914)		Mundhaken	Vordere ventrale Halsspangen stücke	Obere Halsspange		Dorsale Halsspange	Ventrale gräte des pharynx	Dorsale gräte des pharynx
Snodgrass (1924)	Pharyngeal skeleton	Oral hooks	Sclerites in floor of pharynx	Triangular plate	Arms of triangular plate	Bridge plate in roof	Dorsal wing plates	Posterior lateral plates
Efflatoun (1927)	Cephalo-pharyngeal skeleton	Mandibular sclerite	Subhypo-stomium	Hypo-stomal sclerite			Cephalo-pharyngeal sclerites	
Lowne (1890–92)		Great hooks	Small pair in floor of pharynx just behind mouth	Hypo-stomal piece	(Drawn but not labelled)		Cephalo-pharyngeal sclerites	

In describing the cephalo-pharyngeal skeleton in the different species, only the lateral aspect is stressed. The figures are not drawn to scale but rather are prepared in a uniform size for convenience in plate arrangement.

Anterior respiratory organs (Snodgrass, 1924, p. 3) are not present in the first instar of the larvae of this family but appear in the second. The anterior respiratory organs of the third stage are newly formed. It is this pair of organs as seen in the last instar of the larval life that will be used in descriptions.

The first thoracic segment (Snodgrass, 1924, p. 3) always bears the anterior respiratory organs. Externally, they project like ears

from the dorsal part of the segment, close to its posterior margin. Each of the main tracheae opens into an atrium or stigmatic chamber. This chamber is a broad area, larger in diameter than the tracheal trunk. It usually extends to the body wall, but outside this it flares to form the projecting respiratory organ. It usually presents many finger-like processes or tubules along the distal end. Each tubule has a minute opening to the outside, either directly through the tip or through a small tube running through the center of the tubule. The number of tubules in a single anterior respiratory organ varies with the species, from three in *Neaspilota achilleae* Johnson, to as many as fifty-three in *Straussia longipennis* Wiedemann. In a few species, the external evidences are reduced to three or four oval rings, similar in appearance to the posterior spiracles. Doubtless these openings indicate the outer ends of the tubules which are shortened and appear as though cut off at the surface.

When studied under the high power of the microscope, the stigmatic chamber shows a yellowish color in contrast to the surrounding parts. The walls of this chamber seem to possess cells of irregular shapes and sizes. However, the reticulum is indeed a spongy mass of exocuticula (Butt, 1937, p. 489, Pl. I, figs. 3, 5, F) which fills the entire chamber. From the outside therefore, the chamber resembles a vase filled with crystal marbles, small blocks, etc. Each species possesses a characteristic type of reticulum, which fact is useful in identification. The reticulum probably acts as a filter to keep particles of dirt from entering the trachea. The limits of the stigmatic chamber are more or less clearly defined. No taenidia are present in the atrial walls, and distally the external respiratory organ does not have a reticulum.

The walls of the external anterior respiratory organ usually have a uniform granular structure, while the tubules exhibit a similar but coarser granulation, especially in the distal third. The small area at the extreme tip which appears clear and translucent, marks the position of the minute spiracular opening through which the air passes. It is near this opening that the duct of the peristigmatic gland terminates.[3] This clear area sometimes extends down through the middle of the tubule.

[3] From MSS of M. E. Phillips, later published as "Anterior Peristigmatic Glands in Trypetid Larvae," 1939. *Ann. Ent. Soc. Amer.*, XXXII, p. 328, fig. 3.

In size and in number of tubules, the anterior respiratory organs vary somewhat even in a single species. Often there may not be the same number of tubules on the left organ as on the right. This is especially true where a large number of fingers are present on the spiracles. In general, they are similar in shape, proportional size and in number of tubules, for all members of a species.

Usually these tubules form a continuous row along the outer edge of the anterior respiratory organ. This is not always the case, however, since three rows are sometimes found, lying close together. *Rhagoletis pomonella* (Walsh) shows such a condition, the two outside rows being much shorter than the middle one. In one species, *Straussia longipennis* Wiedemann, many irregular rows occur, bearing in some instances over fifty tubules.

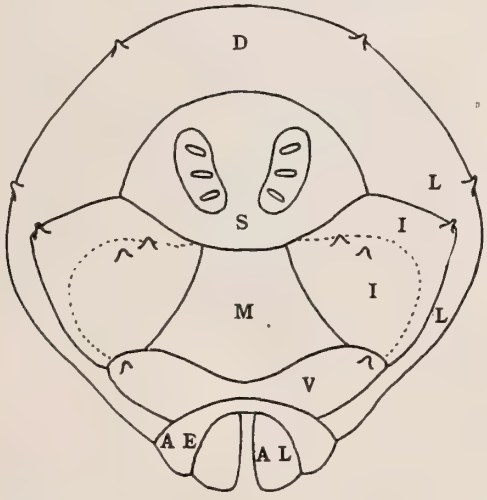
Another very peculiar form is found in one genus, *Procecidochares*. This bears only a few openings, three in one species and five in another. These openings are large and conspicuous and are set in the surface of the body wall itself. At first glance, one supposes that a mistake has occurred and that the posterior spiracle is in focus rather than the anterior respiratory organ. In Varley's paper (1937, p. 112, fig. 2, d.) figures show this same type of anterior respiratory organ in members of the genus *Euribia*.

The figures of the anterior respiratory organs in the present paper, are not drawn to scale and consequently cannot serve to indicate comparative sizes for the different species. The general outlines were traced with a camera lucida, however, so that they give true pictures of the entire part.

In studying the posterior view of the last segment, some difficulty was experienced in finding the proper manipulation of the material for getting sufficient light and an unobstructed view. After various attempts, the writer finally used a watch glass filled with paraffin. In this paraffin, small wells were made with a dissecting needle which were just large enough to accomodate a single larva. In the wells the larvae, taken directly from the alcohol, were placed in a vertical position with their heads down. It was difficult to maintain the proper degree of moisture for best results. When too much was present, the specimen reflected the light, giving only a glare instead of a clear view of the parts. As the surface dried somewhat, the tips of the tubercles would first break through the film of moisture, thus showing the exact posi-

tions of the tubercles in the general outline. If kept too long under the binocular, the specimens dried so rapidly that unnatural wrinkles and cracks became noticeable. The writer feels that in any case too much stress should not be placed on the exact position and extent of the elevations and depressions shown in these figures. However, the actual number of papillae showing at the tips of the tubercles is quite constant and certainly can be used for classification.

There seems to be a rather general pattern of the areas and tubercles. These areas are indicated in the following figure (text fig. 2). A dumb-bell-shaped region lies on the ventral border. This extends around and above the anal lobes. On the lateral enlargements of this ventral area are located the ventral tubercles. The stigmatic area is that flat region surrounding the posterior spiracles. It may be either sunken or raised above the general level. This area is somewhat spindle-shaped and bears no tubercles. The outline of the seventh



Text figure 2. ae. anal elevation; al. anal lobes; d. dorsal area; i. intermediate area; l. lateral area; m. median area; s. stigmatic area; v. ventral area.

abdominal segment shows in the caudal view as an annulus around the last segment. The dorsal region of this seventh segment bears a pair of tubercles widely separated and lying, usually, exactly on the dorsal

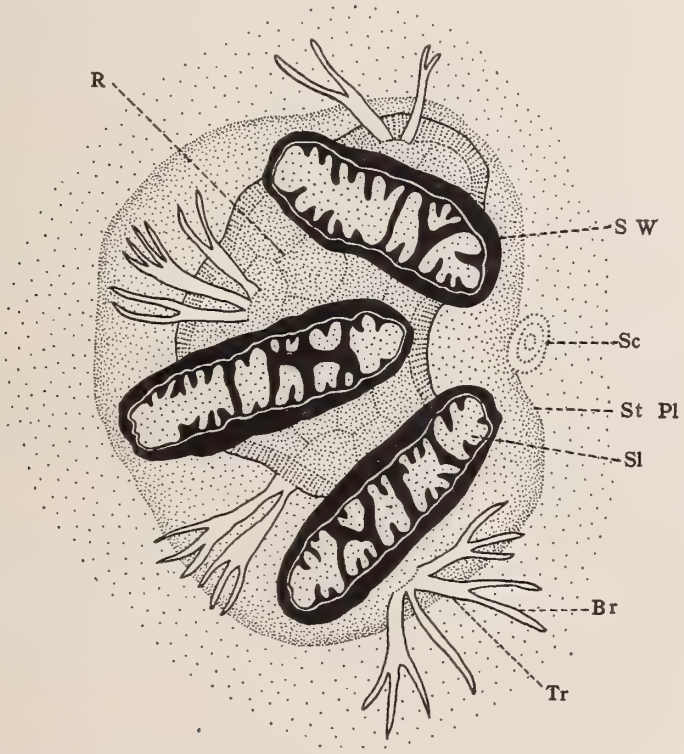
margin thus projecting beyond the outlines of the segment. A pair of lateral tubercles lie near the middle of the lateral borders and these also project beyond the margin. A median region lies between the ventral and stigmatic areas. Usually, there are no tubercles on this median region. The intermediate areas lie, one on each side, in the region between the median and laterals. The tubercles found here vary in number and kind. Often an outer pair is of the usual simple form, while a second pair lies nearer the center and has a more complex structure. It may be bifid or even composed of several divisions, each bearing a prominent differentiated papilla.

The posterior view of the last segment shows other characteristic features. The most conspicuous is the presence of a pair of posterior stigmata. Each of these is made up of a group of three slits, the groups lying opposite to each other near the center of the stigmatic area. The position of these stigmata varies with the species. Using the horizontal median line as a guide, they may be set high toward the dorsal border or low near the center of the posterior face. Also, the distance between the two stigmata varies, as well as the angle at which they are set. Although the stigmatic area may be somewhat raised or sunken, it is never very conspicuously different in level from that of the rest of the segment.

The anus opens near the ventral edge. On either side of this slit-like opening, the anal lobes are situated. These appear like enlarged, globular swellings but are seen only in specimens where they have been everted at death. They vary but little in structure, shape or size.

An enlarged view of the posterior respiratory organ shows details which are of prime importance as morphological distinguishing characters. Each dorsal trachea opens into an atrial or stigmatic chamber, which is bigger than that of the anterior respiratory organ, but of more or less similar structure. The entire upper third of the chamber is filled with a reticulum of exocuticula, according to Butt (1937, p. 489, figs. 3, 5). The meshes of the reticulum may be hexagonal, globular or square, and of great variation in size and arrangement. The general character of the reticulum is fairly constant for a species. Apparently it acts as a filter apparatus to keep dirt out of the trachea. The stigmatic chamber is much larger in diameter than is the trachea. Distally,

the chamber divides into three stalked lobes. At the outer end of each lobe is a trough-shaped structure. The outer margins of these troughs are flush with the surface and represent the slit walls as viewed from the outside. This trough-like structure seems surrounded by a spindle-shaped border, when seen in surface view, the so-called "spindle" of this paper. Actually the spindle outlines the bulged lobe of the stig-



Text figure 3. Sc. scar; St. Pl. stigmatic plate or outline of the stigmatic chamber; R. reticulum of the stigmatic chamber; Sl. stigmatic slit; S.W. slit wall; Tr. trunk of the interspiracular process; Br. branch of the trunk.

matic chamber, on which the trough is set. The heavy sclerotized framework of the inner edge of the slit possesses many teeth or cross-bars, which extend from side to side. Butt (1937, p. 488, fig. 5) in-

dicates that these bars are always on a uniform level, namely on the inner edge or base of the trough, with the teeth always appearing on the opposite or external edge. The writer's slides show these bars at various levels in other species. Often they appear lacking entirely in some fruit-flies. The bars doubtless help prevent the collapse of the slit. Varley (1937, p. 116, fig. 4) discusses the structure of the spiracular slit and figures it as possessing a thin transparent membrane across the apparent opening. This membrane is attached to the spines along the inner edge of the slit and contains a narrow secondary slit, the true opening for the passage of air. No such membrane was distinguished in the trypetid preparations studied.

The stigmatic chamber may often be seen from the surface view, as a more heavily colored area around the slits. This area may be called the "stigmatic plate" since it is evidently the structure referred to by most authors in mentioning that term. This is, however, no true plate but only the outline of the underlying mass of exocuticular structure which makes up the complex posterior respiratory organ. Within the stigmatic plate may be seen the kidney-shaped outline of the narrowed part of the chamber which gives off the three stigmatic lobes. This same surface view shows the reticulum which is made up of large and peculiarly shaped meshes.

The button or scar which marks the position of the external openings of the spiracles of the previous instar, is usually not very conspicuous in this family. It may be found, however, having the appearance of a few wrinkles radiating from a minute depression. The scar lies within the stigmatic plate near the middle of its inner margin. Often a trumpet-like extension may be traced inward from the scar to the stigmatic chamber.

Finally, the interspiracular processes are conspicuous and important. These are the groups of structures set in the surface of the integument between the outer ends of the slits. They may be hair-like, bristle-like or plate-like in character. Interspiracular processes are not peculiar to trypetid larvae. They were described and discussed by Huff (1925) who called them the "sun-ray" structures. His paper deals entirely with calyptrates and consequently his figures do not fit the present family. In the acalyptrates, many prolongations radiate from a common center or diverge from a curved linear base. Both conditions are

common in trypetids although the centers from which they diverge are not conspicuous and have never been observed when no rays were present. However, Varley (1937, p. 116) indicates minute clear areas in *Euribia* at the correct position to suggest that these represent the disappearing processes which had been noted in the previous instar. Metcalf (1919) described similar structures in syrphids and gave elaborate figures in illustration. However, in each figure, the processes are shown as being much more complicated than any seen in fruit-flies. Metcalf named these structures "plumose interspiracular hairs." Since in many species these assume the form of plate-like prolongations, the term seems inadequate.

Usually on well-prepared slides, the processes may be readily distinguished under the high power but since they are translucent, may escape the first examination. It is possible that all members of the family possess these structures. No interspiracular processes were discovered in the genus *Eurosta*. Only two species, *E. comma* Wiedemann and *E. solidaginis* Fitch were available for study, but a large number of slides were prepared and painstakingly examined without demonstrating their presence. In all other species, the interspiracular processes were observed.

When present, there are always four groups of the processes on each stigmatic plate, which are arranged so as to form an encircling border around the entire group of six slits. Wherever seen, these processes have always been set at an angle in the wall and always slope upward and away from the slits.

The simplest form of interspiracular process is a single conical structure which apparently rises from the body wall in the position indicated in Plate XIII, fig. 165. Varley (1937, pp. 120–121, figs. 6–7, f.) also figures similar types of processes. Another type consists of a number of trunks which arise from a common basal piece, or are grouped together in a spreading crescent-shaped formation without the basal structure. Still others possess branches from the primary trunks which take on various shapes and forms.

As to the function of the interspiracular processes, the writer can only speculate. They may be atrophied from former useful organs and perform no service to the present forms. In cases where the larvae

live in juicy fruit or in other semi-liquid media, the processes may help to keep the spiracular slits on the surface where oxygen is available. They may wave back and forth to create a current which deflects dirt particles from the spiracular openings. Finally, glands may be present which exude an oily or sticky substance. This, if poured out over the processes would help them to pick up foreign particles more readily. Although Butt (1937) did not find such glands, nevertheless his slides showed the interspiracular processes to be viscid and covered with debris.

In making the figures of the posterior respiratory organs care was taken to have each one placed at the proper angle to the vertical. The figures therefore give the true position of the organ in reference to the other member of the pair of spiracular slits. The figures are not made to scale.

Key to the Identification of the Species Studied

1. Larvae possessing anterior respiratory organs which show as apertures, surrounded by nearly circular sclerotization, and much resembling exterior view of posterior stigmata 2
   Anterior respiratory organs consisting of a group of protruding tubules arranged somewhat fan-shaped 3
2. Dark brown blotch on dorsum of maggot; extremely heavy hypostome **Procecidochares australis**
   No such dark blotch on dorsum; cephalo-pharyngeal skeleton delicate, with long and narrow hypostome **Procecidochares atra**
3. Anterior respiratory organ with less than ten tubules 4
   Anterior respiratory organ with ten or more tubules 15
4. Posterior view of caudal segment with large dark blotch in center 5
   Posterior view of caudal segment without dark blotch 6
5. Interspiracular processes small, of four to five lanceolate fingers each **Trypeta florescentiae**
   Interspiracular processes of eight to nine trunks, needle-like and somewhat branched ..... **Xanthaciura insecta**
6. Larvae distinctly barrel-shaped 7
   Larvae not barrel-shaped, although sometimes a bit enlarged in middle 9
7. Slits of posterior stigmata long and narrow; interspiracular processes present, with many needle-like trunks ..... **Paracantha culta**
   Stigmatic slits short and wide, oval in outline; no interspiracular processes present 8

8. Anterior respiratory organ with only five tubules; stigmatic area of caudal segment triangular in outline ..... **Eurosta solidaginis**
   Anterior respiratory organ with six to seven tubules; stigmatic area of caudal segment oval in outline ..... **Eurosta comma**
9. Interspiracular processes never branched, although sometimes a finger shows a marginal indentation in the outer fifth 10
   Interspiracular processes branched, even though sometimes only sparingly 12
10. Fingers of interspiracular processes broad, but lanceolate, a few always notched in outer fifth; posterior view of caudal segment with no spinules ..... **Tephritis finalis**
    Fingers of interspiracular processes not notched at tip 11
11. Posterior spiracular slits with cross-bars and with oval, extremely heavy slit walls ..... **Neaspilota albidipennis**
    Posterior spiracular slits ovate, with neither crossbars nor teeth projecting into the slit, but with slight irregularities along inner edge **Paroxyna picciola**
12. Posterior spiracular slits with crossbars and teeth extending into the cavity ..... **Trupanea abstersa**
    Spiracular slits without crossbars 13
13. Posterior spiracular slits long and narrow, at least three times as long as wide, with nearly parallel walls ..... **Trupanea subpura**
    Slits short, not more than twice as long as wide 14
14. Spinules present on posterior aspect of caudal segment **Neaspilota achilleae**
    No spinules on posterior aspect of caudal segment . **Trupanea actinibola**
15. Anterior respiratory organ with forty to sixty tubules scattered over a wide, flat distal surface ..... **Straussia longipennis**
    Anterior respiratory organ with the tubules usually set in a single line along distal edge and sometimes crowded to form three rows; not more than 35 tubules at most 16
16. Spiracular slits with no crossbars nor sharp teeth extending into the slit ..... **Euaresta aequalis**
    Many crossbars or sharp teeth in posterior spiracular slits 17
17. Each wall of posterior spiracular slit approximately the width of the slit ..... **Trupanea jonesi**
    Wall of posterior spiracular slit much thinner 18
18. Multiple tubercles in intermediate area, 7 papillae arising from a single base ..... **Ceratitis capitata**
    Intermediate tubercles never more than bifid 19
19. Caudal segment bearing spinules on the anal elevation **Anastrepha serpentina**
    No spinules on caudal segment 20

20. Cephalo-pharyngeal skeleton very delicate, long and slender; hypostome seven times as long as deep ..... **Acidia fratria**
Hypostome not nearly seven times as long as deep 21

21. Minute sunken spots or diamond-shaped depressions visible on caudal segment 22
If present, depressions on caudal segment are elongate, in the form of lines or furrows 23

22. Diamond-shaped depressions, about twelve in number, set in regular pattern on caudal end (four in dorsal area and four on each side of the ventral limit of the intermediate area); no tubercles nor papillae on posterior view of caudal segment ..... **Trypeta palposa**
Many punctate depressions scattered over the area between intermediate and ventral tubercles; many papillae .... **Zonosemata electa**

23. Cephalo-pharyngeal skeleton with very short dorsal wings, which are deeply cut posteriorly to form extended prolongations ... **Dacus oleae**
Dorsal wings not conspicuously short 24

24. Inner intermediate tubercles bifurcated or paired 25
Inner intermediate tubercles single 36

25. Interspiracular processes composed of unbranched fingers **Rhagoletis juniperinus**
Interspiracular processes branched 26

26. Fingers of the interspiracular processes numbering from two to five . 27
Fingers of the interspiracular process many more than five 29

27. Fingers very short, no more than one-fourth the length of the corresponding slits ..... **Anastrepha pallens**
Fingers at least half the length of the slit 28

28. Anterior respiratory organ with about ten tubules; outline of external organ evenly rounded distally ..... **Rhagoletis berberis**
Anterior respiratory organ with about 15 tubules; external organ flared and recurved at sides ..... **Rhagoletis ribicola**

29. Posterior view of caudal end with very few papillae, one dorsal, one ventral and one pair intermediates on each side ... **Dacus ferrugineus**
Caudal end with numerous papillae 30

30. Inner intermediate papillae of bifid form, but drawn out in a thin ridge between the tips 31
Inner intermediates not forming a ridge 32

31. Anterior respiratory organs with long, narrow stigmatic chamber; tubules numbering about nineteen ..... **Rhagoletis cingulata**
Anterior respiratory organ with low and broad stigmatic chamber; about twenty-five tubules present ..... **Rhagoletis suavis**

32. Hypostome rectangular in lateral outline; fully twice as long as deep 33
Hypostome triangular in lateral outline; only a little longer than deep **Anastrepha ludens**

33. Interspiracular process bearing nine to twelve branches **Zonosemata setosa**
Interspiracular process with fifteen to thirty-one branches 34

34. Caudal segment with 9 pairs of tubercles ....**Rhagoletis symphoricarpi**
Caudal segment with six pairs of tubercles 35

35. Usually found in apple or *Crataegus* .....**Rhagoletis pomonella**
Usually found in *Vaccinium* .....**Rhagoletis mendax**

36. Commonly from fifteen to thirty-three branches in individual interspiracular processes 40
No more than 12 branches in any interspiracular process 37

37. Practically no branches occur in the interspiracular process (rarely one or two may occur); straight lanceolate fingers ...**Zonosemata** sp
Many branches in interspiracular processes 38

38. Interspiracular processes well over half the length of corresponding slits .....**Rhagoletis cerasi**
Interspiracular processes scarcely half the length of the slits 39

39. Many tubercles on caudal segment .....**Epochra canadensis**
Caudal segment very smooth in posterior view; only a few pairs (usually two) of papillae .....**Toxotrypana curvicauda**

40. Interspiracular process not more than half as long as slits 41
Interspiracular process well over half the length of slits 43

41. External part of anterior respiratory organ antler-like, spreading high at sides and with tubules of varying sizes and shapes ..**Myoleja limata**
External part of anterior respiratory organ not antler-like 42

42. Hypostome about the same length as the mouth hook; combined length of hypostome and mouth hook fully half the length of the dorsal wing .....**Rhagoletis completa**
Hypostome little more than half the length of mouth hook; combined hypostome and mouth hook not more than one-third the length of dorsal wing .....**Bactrocera cucurbitae**

43. Dorsal wings rising abruptly, high above the hypostome at dorsal arch and there projecting forward over the parastomals 44
Dorsal wings rising very little at dorsal arch and not projecting over the parastomals .....**Rhagoletis juglandis**

44. Maggots found in wild cherries; wing pattern of adults very unlike that of the following species .....**Rhagoletis indifferens**
Maggots found in cultivated cherries .....**Rhagoletis fausta**

Acidia fratria (Loew)

1862. *Trypeta fratria* Loew, Mon. Dipt. No. Amer., 1, p. 67.

This species is closely related to the parsnip fruit-fly of Europe (*Philophylla heraclei* (Linnaeus). Loew states in his original description that *A. fratria* closely resembles the light form of *Acidia heraclei.* Frost (1923, p. 32) considers the present species only a synonym of the European species and his host plant records are therefore combined for the two. DeVos-DeWilde (1935, p. 27, Pl. 19) figures *P. heraclei* and shows so many dissimilar features that the European and American species can scarcely be synonymous. He shows the posterior stigmata lying almost parallel to the mid-vertical line, while in the American species, they are farther separated dorsally than they are ventrally. Also, the slits themselves are very dissimilar in the two forms. The cephalo-pharyngeal skeleton likewise differs from that of the American species, especially in the shape of the mouth hook.

Acidia fratria (Loew) was reared by Doane (1899, p. 178) in the western states from *Heracleum.* Frost records it as reared from *Prenanthes canadense,* from *Cryptotaenia canadensis* (L.) DC, and from *Pastinaca sativa* L.

Frost (1924, p. 32) states that this species produces irregular blotch mines, with several larvae living within a single mine. In time, the excavation becomes very large, the epidermal layers of the leaf being so separated that a large pocket is formed within the leaf. The mine is usually blackish and discolored by frass and moisture contained within. The mature larvae often transform inside the mine, but may escape and attach themselves to the surface of the leaf before pupation. In either case, this is a species which does not crawl into the ground before transformation. DeVos-DeWilde (1935, p. 97) on the other hand, states that *Philophylla heraclei* pupates under the ground or rarely in the plant itself.

Described from three specimens reared by S. W. Frost at Ithaca, N. Y. from *Prenanthes canadense.*

Larva about 8 mm. long and 2 mm. in diameter (measurements from mounted larval skins); of usual elongate shape, though caudally somewhat more truncate than is usual in this family; no fusiform areas noticed.

Skin smooth except for the small and inconspicuous ambulatory spinules; spinules straight-sided, scarcely hooked at tips and occurring in the following

regions: upper anterior area of first thoracic segment with a marginal band, the spinules directed backward; a fairly wide band encircling the body near the union of second and third thoracic segments, made up of spines in short, slightly curved lines; similar bands on next three segmental intersections; only a few bands farther caudad; a few scattered lines along each of the remaining intersegmental lines, all becoming increasingly smaller and indistinct posteriorly; anteriorly the bands lying diagonally across the body, extending from the antero-dorsal area to the ventro-caudal in direction, but gradually changing until parallel to the segment divisions caudally.

No sign of posterior or anterior sense organ seen; stomal sensory papillae present.

Cephalo-pharyngeal skeleton (Pl. I, fig. 1) unique, small, much elongated and narrowed; hypostomal sclerite almost rectangular in side view, nearly seven times as long as deep; posterior pharyngeal plates and dorsal wings all long and narrow; mouth hooks much reduced in size.

Anterior respiratory organ (Pl. V, fig. 46) fan-shaped; fourteen to seventeen tubules along the outer margin; external part nearly as deep as the stigmatic chamber; reticulum with rather irregular and small meshes, ten or eleven stretching across the wider and outer extremity of the chamber as seen in profile; tubules small, straight-sided, rounded distally, one-third as long as the stem.

Caudal segment (Pl. IX, figs. 100–101) with raised dorso-central piece, as viewed in profile, this raised piece with four tubercles, one at each corner; stigmatic area somewhat sunken; dorsal tubercles far apart, near the outer edges of the stigmatic area and just above the laterals; ventral and lateral tubercles as usual; one pair of intermediate tubercles near the inner corner and about on the middle transverse line; posterior stigmata well above the middle and about the length of the stigmatic plate apart, lying not quite parallel to those of opposite side, the ventral extremities being closer together than the dorsal ends.

Slit walls of the posterior stigmata (Pl. XI, fig. 148) heavily sclerotized, with a number of crossbars seemingly at the surface; slits rather broad in proportion to the length; upper wall of stigmatic chamber with narrow marginal area apparently striated, the remainder filled with a reticulum made up of prominent hexagonal meshes; each group of interspiracular processes with two lanceolate trunks set close together, flaring distally but with no branches and no apical indentations.

Recognition characters.—(1) The cephalo-pharyngeal skeleton is long and narrow, the hypostome being conspicuously long, nearly seven times its depth. (2) In the lateral view, the caudal end shows a raised area in the dorso-central region, with tubercles set one on each corner. (3) Each interspiracular process is made up of two lanceolate projections, which are unbranched and possess no apical indentations.

Anastrepha ludens (Loew)

1873. *Trypeta ludens* Loew, Mon. Dipt. No. Amer., III, p. 223.

The "Mexican fruit-fly" or "Orange worm" is a serious pest in tropical Mexico. Its range extends south to Panama and at one time it was introduced into Texas. In the United States, however, extreme measures were taken to exterminate it. Such measures added to unfavorable climatic conditions were so successful that its range is still limited to Mexico. The larvae attack oranges, sweet limes, mangoes, peaches, plums, guavas, etc. This is one of the important pests against which strict quarantine is maintained in this country.

The female deposits eggs in the oranges at the time the fruit begins to show color. The newly hatched larvae then eat and burrow into the pulp of the fruit. The maggots take on the color of their food, and when small are easily overlooked in table fruit. Often the infested fruit shows external marks of injury where oviposition took place, but it may appear quite sound from the outside. When full grown, the larvae emerge through conspicuous exit holes, this usually happening after the oranges have fallen to the ground. Many maggots are found in a single fruit and eat freely through the entire pulp until in the later stages half of the pulp may be devoured and the remainder left to rot and decay.

Described from thirty specimens reared from mango, April, 1931 at Experiment Station, Mexico, lent by O. A. Johannsen.

Larva measures 9 to 11 mm. long and 1.5 mm. in diameter; body of usual cylindrical shape; seven fusiform areas visible to the naked eye, with an eighth smaller one between thorax and abdomen, apparent in mounted specimens.

Surface somewhat wrinkled; spinules normally conspicuous, conical, hooked, confined when present on the abdomen, to the fusiform areas; set in slightly curved, transverse lines; a narrow band of spinules between second and third thoracic segments occupying venter and lower third of the sides; a narrow band encircling the body between first and second thoracic segments; another with all spinules directed backward, on the upper anterior region of the first segment and extending laterally; individual lines rather long in caudal area, but short anteriorly; spinules very tiny on the thorax, twelve to fifteen making up a short line.

Anterior sense papillae present, two-segmented, with distal segment flat on top; posterior sense papillae present, of usual shape, four sensoria on distal end; stomal sense organs and guards not seen; stomal ridges prominent, seven to nine in number.

Cephalo-pharyngeal skeleton (Pl. I, fig. 2) large and heavy; mouth hooks rather slender and pointed at tip, twice as long as deep, slightly longer than hypostome; parastomals and sub-hypostomal pieces present.

Anterior respiratory organs (Pl. V, fig. 47) small, slightly flared, external area two or three times deeper than stigmatic chamber; twelve to sixteen tubules rounded at tips, with only a few clear areas to indicate spiracular openings, tubules about one quarter the length of deepest part of the stem; reticulum with small irregular rectangular meshes, about twelve across one side of chamber.

Caudal segment (Pl. IX, fig. 102) rather smooth, in side view presenting only slight deviation from a rounded outline; posterior view with small tubercles and some papillae set in various places where no evidences of tubercles are present; ventral tubercles distant from each other; laterals as usual; dorsals close to stigmatic area, slightly farther apart than posterior stigmata; supernumerary pair of tubercles lying close to the dorsals, slightly ventro-laterad; two pairs of intermediate papillae, close together near inner edge of the single tubercle, which occupies entire area; posterior spiracles small, slightly above the middle; spiracular plates somewhat darkened, tilted toward each other, and raised on outer edge; spiracular plates lying parallel to each other, and the dorsal slit of the right side almost in a straight line with that of the left.

Spiracular slits (Pl. XI, fig. 149) long and narrow, less than one-third as wide as long; slit wall narrow with many crossbars; two upper slits on right side parallel to each other; posterior stigmatic plate large, but upper surface of stigmatic chamber rather small; indistinct vacuolate reticulum with meshes of small size; spindles prominent; interspiracular processes large and showy, with seven to fifteen needle-like, somewhat curved trunks and seventeen to thirty branches, almost half as long as spiracular slits.

Recognition characters.—(1) Only one band of spinules completely encircles the body, and it is placed between the first and second segments. (2) A pair of supernumerary dorsal tubercles are visible. (3) The stigmatic plates are set parallel to the vertical line. (4) Slits are long and narrow, interspiracular processes are large and possess many branches.

Anastrepha pallens Coquillett.

1904. *Anastrepha pallens* Coquillett, Jour. N. Y. Ent. Soc., XII, p. 35.

This species has been captured in traps in grapefruit and orange trees. It was reared from berries of *Bumelia angustifolia* by Greene in 1934. The species is recorded from Texas and Honduras only.

Described from eight specimens taken at Donna, Texas and lent to the author by J. W. Monk.

Larva measures 8 to 9 mm. in length and 2.5 mm. in diameter, much resembling *Anastrepha ludens* Loew, but stouter and darker in color than that species; nine prominent fusiform areas visible to the naked eye.

Spinules of average size, strongly curved but not truly hooked; a band, eight to nine lines wide, of rather heavy spinules running half way down the sides, on the antero-dorsal part of the first segment; spinulose area along all subsequent intersegmental lines, but first two with no fusiform areas; narrow encircling bands where no fusiform areas are seen, but spinules confined to such areas wherever the latter occur.

Anterior sense organs present, two-segmented, distal segment minute, rounded at tip, first segment high and narrow; posterior sense organs about as high as wide, collar not as high as the four sensoria set within; stomal sense organs not seen; guards absent; stomal ridges prominent and numerous, about fourteen on each side.

Cephalo-pharyngeal skeleton (Pl. I, fig. 3) somewhat longer and narrower than in *Anastrepha ludens* Loew, but with the mouth hooks heavier and hypostomal sclerites short and wide; slight irregularities in outline of mouth hook, but these not constant in different individuals; depth of skeleton at point of dorsal arch only twice as great as depth of hypostome; parastomals and subhypostomal pieces present.

Anterior respiratory organ (Pl. V, fig. 48) rather large, external part fan-shaped, but flared, two to four times deeper than the chamber; reticulum with large square meshes, only eleven across one side of the wide chamber; tubules one and one-half times the depth of shallowest part of the stem, sixteen to twenty-five in number, usually straight-sided and rounded distally, but sometimes bulged near the tip; tube-like clear areas at apices of a few tubules, indicating the position of spiracular openings.

Caudal end (Pl. IX, fig. 103) rugged and with many protuberances; tubercles large and conspicuous; in side view the tubercle bearing the two inner papillae of the intermediate area, jutting out sharply near the middle of the profile; posterior spiracles not visible from side, but in posterior view, lying above the mid-horizontal line; spiracular plate not visible in alcoholic specimens, but distinct when examined under the microscope; the slit walls sclerotized and highly colored, the spiracles appearing like tiny dark-colored seeds lying on the surface; stigmatic area somewhat sunken, with spiracular plates sloping dorsally and laterally from the middle; stigmatic plates nearly parallel to each other, but two to three times the width of one slit apart ventrally and three and one-half times dorsally; ventral area in the form of a narrow roll, with widely separated ventral papillae present; lateral tubercles as usual; dorsal papillae lying on the dorsal margin and with two pairs of supernumerary papillae nearby, placed ventro-laterad of the dorsals; intermediate area with two prominent tubercles, the outer one carrying a single papilla, the inner with two lying close together, just below the stigmatic area.

Spiracular slits (Pl. XI, fig. 150) rather short, at least two-fifths as wide as long; dorsal slit of right side lying about in a straight line with that of the left; slit walls very heavy, with a few teeth along the rim, as well as seven crossbars at the surface, the latter being X, Y and H-shaped; stigmatic chamber with the usual large meshes in the reticulum; spindles prominent.

Interspiracular processes small, fingers only one-sixth as long as spiracular slits; fingers with two or three trunks coming off at base in a group; sometimes trunks arising independently, but with only a few true branches.

Recognition characters.—(1) The anterior sense organ has a long, straight-sided first segment and a very small distal one, which is rounded at the tip. A collar lies between the two segments. (2) The mouth hooks are heavy, about as long as deep, while the cephalopharyngeal skeleton is rather long and narrow in general outline. (3) The intermediate area bears two tubercles, the inner one of which has two papillae set close together, appearing almost bifid. (4) Two pairs of supernumerary dorsal papillae are present. (5) The interspiracular processes have fingers made up of two or three trunks arising together from a common base, the entire process being very small and with only a few true branches.

Anastrepha serpentina (Wiedemann)

1830. *Dacus serpentina* Wiedemann, Aussereur. Zweifl. Ins., II, p. 321.

The "Dark fruit-fly" has been taken in Texas, Mexico, Honduras, Guatemala, Costa Rica, Canal Zone, Ecuador, Peru, Brazil and Trinidad. The larvae infest fruits of various plants, including star-apples and cultivated sapodillas.

Described from four specimens collected by Greene in the Canal Zone and lent by the United States National Museum for study.

Larvae large, 9 to 10 mm. long by 1.5 mm. in diameter; of the usual elongate shape; eight fusiform areas present, the first one, lying between thorax and abdomen, very small; fusiform areas wider in the middle and posterior regions of the body.

Spinules rather small, anterior ones minute, slightly curved or straight, never hooked; spinules scarce on the antero-dorsal corner of the first segment, lying near the dorsal border; spinulose band between thorax and abdomen narrow, only seven lines in width; posteriorly, the spinules more numerous, widest band with sixteen to seventeen lines.

Anterior sense organs present, the two segments equal in length, but the distal one no more than half the diameter of basal segment and rounded at tip; pos-

terior sense papillae present, of a single segment, wider than high, with four or five sensoria on the flat top; stomal sense papillae not found; guards absent; stomal ridges visible, eight or nine on each side.

Cephalo-pharyngeal skeleton (Pl. I, fig. 4) large; mouth hook nearly three-fourths as deep as long, the distal end rather slender and pointed, some minute notches along the lower edge of the hook, which seem too small and irregular to have much significance; depth of skeleton at dorsal arch at least four times that of hypostome; hypostome twice as long as deep; parastomals and sub-hypostome visible.

Anterior respiratory organs (Pl. V, fig. 49) small, external part fan-shaped and flared at the sides; at shallowest point, the external portion not quite so deep as the stigmatic chamber; reticulum made up of rather small hexagonal meshes, some eighteen extending across one side of the top of the chamber; tubules small, only half as long as the stem; tubules somewhat bulging near tips, sixteen to nineteen in an irregular row.

In posterior view (Pl. IX, fig. 104) the last segment very different from that of other members of the genus studied, very smooth and with all depressions very slight; only four inconspicuous tubercles, bearing noticeable papillae; one pair of dorsal tubercles about half way between stigmatic area and the dorsal margin, somewhat farther apart than the outer edges of the spiracular plates; the second pair of tubercles in the intermediate area, almost directly below the dorsals; spiracular plates well above the middle line, raised above the surface, nearly parallel to each other; slits separated by twice the width of one at dorsal end, while slightly closer at the other; anal elevation bearing several rows of spinules.

Posterior respiratory organ (Pl. XII, fig. 151) of average size; spiracular plate normal; slits short and heavy, with walls of average thickness; no teeth on sides of slits, all prolongations extending across as bars or lattices, several often uniting; reticulum with large round meshes, five of these extending across the widest part; no spindles showing; interspiracular processes rather large and branched, six to nine trunks with ten to sixteen branches; fingers needle-shaped, usually only once branched, or not at all, but occasionally a single one with four branches.

Recognition characters.—(1) The spinules on the first segment are tiny but few, while no spinulose bands completely encircle the body. (2) The larva appears smooth and rounded in posterior aspect; only small tubercles are present, but four prominent papillae are visible, namely one pair of dorsals and one pair of intermediates. (3) The anal elevation bears many spinules. (4) The spiracular plates are raised on a disc. No spindles present.

Bactrocera cucurbitae (Coquillett)

1899. *Dacus cucurbitae* Coquillett, Entom. News, x, p. 129.

The "Melon fly" is a common pest in Hawaii, where it does much damage to various kinds of melons and related fruits. It has been listed by Pierce (1917, pp. 24, 25, 38) as attacking apple, apricot and bean, although the fly seems of little economic importance to them. The species is a native of India, but it is also found in Ceylon, Japan, China and the Philippines. After the melons are set on the vines, the flies oviposit in the stems and the resulting maggots work down into the fruit destroying the tissues. Small melons are often completely hollowed out by these larvae. The dry skin is then very easily punctured by the full-grown maggots which crawl out and pupate in the ground beneath the fruit.

Described from four specimens, taken in Honolulu, which were lent by the United States National Museum.

Larvae large, 8 to 11 mm. in length and 2 mm. in diameter; elongate, tapering toward cephalic end; whitish; fusiform areas of abdominal region very narrow and attenuated; a much smaller fusiform area discernible between thorax and abdomen.

Spinules very small, broader and shorter than usual, a few of the central ones in each fusiform area much larger; spinules straight or curved, but never hooked; spinules present on all fusiform areas; also a rather wide band of eight lines on the anterior margin of the first segment, this encircling the body; narrow spinulose band also encircling the body between first and second thoracic segments; a ventral band which runs half way up the side between second and third thoracic segments, lying along intersegmental lines.

The anterior sense papillae two-segmented, basal one rather flat with a second smaller cone-shaped segment set inside the distal edge of the first; posterior sense organ of larger diameter, with a rim set up along the distal margin, five or six sensoria inside the rim and rising to the level of the outer edge; no stomal sense papillae and no guards; stomal ridges numerous and very apparent, fourteen on each side of mouth.

Cephalo-pharyngeal skeleton (Pl. I, fig. 5) large, with broad wings; mouth hook smaller than average, more than two-thirds as deep as long; with rather slender, pointed distal end; hypostome small, rectangular, not as long as depth of mouth hook; parastomals and subhypostomal sclerites present.

Anterior respiratory organs (Pl. V, fig. 50) with external parts somewhat fan-shaped, but nearly flat across top, broad and deep, twice as deep as the stigmatic chamber; small meshes of reticulum hexagonal, eighteen across one

side; tubules small, thick and short, straight-sided and rounded toward the tip, seventeen to nineteen in number; tubules one-half as deep as stem.

Caudal end (Pl. IX, fig. 105) smooth in outline, rounded in profile; no tubercles but three pairs of tiny papillae, namely, dorsals in pits directly above the stigmatic region, laterals bordered by tent-like elevations and intermediates just below slits on mid-line, with spiracular plates half-way between them and the dorsal margin; spiracular plates set at a slight angle, with ventral slits of right and left spiracles approaching a straight line; other two slits of each side parallel to each other; a rather deep depression between the right and left stigmatic plates and the latter elevated; posterior stigmatic plates about one and one-half times the length of one slit apart.

Posterior respiratory organs (Pl. XII, fig. 152) with rather large, round spiracular plates; distal wall of stigmatic chamber narrowly kidney-shaped and long; reticulum with large indistinct hexagonal meshes; spindles prominent; slits somewhat smaller than the average; walls of usual width but with heavy interlocked crossbars and some short branched projections (the only instance of such branching which was observed in the entire study); interspiracular processes very wide, but individual fingers not abnormally long, about one-third as long as one slit; a large number of fingers lying close together like the teeth of a comb, this likeness prevailing even when the fingers are branched; the largest process bearing seventeen trunks and thirty-four branches.

Recognition characters.—(1) A complete ring of spinules lies around the anterior edge of first segment. (2) In profile the caudal edge is evenly rounded with no prominent tubercles. In posterior view the larva is very smooth, all depressions are minute with small papillae noticeable but not set at top of raised mound or tubercle. (3) Teeth of slits sometimes possess spine-like branches. (4) Interspiracular processes have many sub-parallel fingers arranged in a compact row.

Ceratitis capitata (Wiedemann)

1829. *Tephritis capitata* Wiedemann, Anal. Entom., p. 55.

The "Mediterranean fruit-fly" is probably the most serious trypetid pest in the world. Efflatoun (1927, p. 26) gives its range as Continental Africa, India, Australia, New Zealand, East Indies, Bermuda, Azores, South America, Cape Verde Islands, Madeira, Hawaii and Southern Europe. A few years ago, an infestation occurred in Florida but this was apparently checked. Probably this species was a native of Africa and doubtless was primarily a citrus pest. As it spread, it accepted many kinds of fruits as food until now there is hardly any sort from which it has not been bred. The females deposit eggs under

the skin of the fruit which is just beginning to turn ripe, preferably in some break already occurring in the skin. Several females may use the same deposition hole with the result that as many as seventy-five eggs have been found centered in one spot. When the larvae hatch, they immediately begin eating and at first tunnels are formed, but these soon become untraceable. However, many larvae which hatch from one oviposition may keep close together in feeding until nearly full grown.

Described from seventy specimens mostly from Honolulu, but a few from Florida.

Maggot elongate, medium sized, whitish, 7 to 9 mm. in length and 1 to 2 mm. in diameter; fusiform areas small and narrow but as long as usual, visible to the naked eye, and situated in the ventral region of the last eight intersegmental areas.

Spinules small or minute, curved or straight but never hooked; present on all fusiform areas; also a narrow spinulose band, about five lines wide on anterior end of first segment; another narrow band encircling the body between first and second, and a third spinulose band between second and third thoracic segments.

Anterior sensory organs present, two-segmented, basal one twice as long and twice as wide as the distal cone-shaped segment; posterior sense papillae wider than high, with four sensoria; stomal sense organs not seen although Silvestri (1914, p. 43, Pl. 2, fig. iv, 4–5) figures them; no guards; stomal ridges prominent, nine on each side.

Cephalo-pharyngeal skeleton (Pl. I, fig. 6) large, dorsal wings and pharyngeal plates all broad; mouth hook large with a long and narrow distal end and a small abrupt prolongation of dorso-caudal corner; hypostome more than twice as long as deep, but only two-thirds the length of the mouth hook; parastomals and subhypostome present.

Anterior respiratory organ (Pl. V, fig. 52) practically flat along its distal edge; external area six times as deep as stigmatic chamber; reticulum with rectangular small meshes, thirteen or fourteen across one side; nine to eleven large tubules, one-third as long as the entire external part, bulged slightly near tip, where flat marginal areas indicate positions of spiracular openings.

In profile (Pl. IX, fig. 107) caudal end rugged and prominently tuberculate, with papillae numerous; one posterior spiracle plainly visible; posterior stigmata situated somewhat above the middle when seen in posterior view (Pl. IX, fig. 106), plates raised on dorsal side, nearly parallel, slightly farther apart dorsally than at ventral ends; spiracular plates about the length of one slit apart; a pair of dorsal tubercles set farther apart than the stigmatic plates, each bearing a bifurcated tip, or double set of papillae; a supernumerary pair of lateral papillae about half way between the true laterals and the dorsal papillae; ven-

tral tubercles and papillae normal; intermediate tubercles quite unique, the dorsal edge of each side bearing about seven minor extensions set closely together in a row, each with a papilla at tip.

Spiracular plates (Pl. XII, fig. 153) large; slits a little less than five times as long as wide; slit walls normal with many irregularly placed crossbars and a few teeth; the two ventral slits of left side parallel to each other; distal wall of stigmatic chamber large in outline, reticulum with long, hexagonal meshes, four or five across greatest width; interspiracular processes large, with apparent basal pieces; fingers needle-like, scarcely curved and with few branches;[4] eight to sixteen trunks in specimens studied.

Recognition characters.—(1) The spinules are arranged in narrow bands around the anterior edge of the first segment, between first and second and also between second and third thoracic segments. (2) Anterior respiratory organ is flat across distal edge. (3) Intermediate tubercles bear seven smaller extensions, with papillae set closely together in a dorsal row.

Dacus ferrugineus (Fabricius)

1794. *Musca ferruginea* Fabricius, Entom. Syst., IV, p. 342.

The "Mango fruit-fly" is found in India, Ceylon, Java, Australia, China and Japan. The maggots usually feed upon the fruits of mangoes, oranges, guavas and peaches, although bred from other species as well.

Described from two specimens, collected in Japan and lent by the United States National Museum.

Larva long, of usual shape, measuring 15 mm. by 4 mm. in diameter (measurements taken from prepared slides); fusiform areas broad and long.

Spinules either straight or strongly curved, prominent; lines long, not much curved; forty to fifty spinules in a single line; all intersegmental areas bearing wide bands of spinules, nine to ten lines wide in thoracic region and broadening in the abdominal area into twenty to twenty-two lines; the wider bands about as wide as the spaces between them; the only spinulose band encircling the body, found on the anterior border of the first segment, where nine to ten rows of stiff and heavy closely set spinules lie in long slightly curved rows.

Anterior sensory organ present, two-segmented, basal segment square in profile, second segment nearly as long but only half as wide, and rounded distally, no collar; posterior sense organ as high as the anterior one, somewhat longer than its own width, with a small group of sensoria set on a raised dais,

[4] Efflatoun, (1927, Pl. 5) shows many more branches and gently curved trunks.

which is one-third the width of the entire papilla; no stomal sense papillae seen, and no guards; stomal ridges evident, rather small and closely placed, nine to eleven in number.

Cephalo-pharyngeal skeleton (Pl. I, fig. 7) of average size; hypostome rectangular; subhypostome lying close below it and parastomals prominent; dorsal wings unusually narrow, longer than the pharyngeal plates.

Anterior respiratory organ (Pl. V, fig. 51) of average size, external part shallow and wide, greatly flared and deflexed at sides; central tubules as long as the stem; external part only one-third as deep as stigmatic chamber; atrial reticulum with large flat, hexagonal meshes, six across top of one side of the chamber; thirty-four very small tubules, crowded so closely together as to make the row irregular; whole external region filled with heavy granular material; no visible indications of spiracular openings.

In profile the caudal segment with an evenly rounded outline, the intermediate tubercles visible on the margin, situated above the middle; posterior stigmata also seen in profile, lying about half way between the intermediate tubercles and the dorsals; in posterior view (Pl. IX, fig. 108) the whole area very smooth and rounded, with depressions and tubercles all shallow; outline deeper than wide in general shape; ventral tubercles set high above the small anal lobes, the anal elevation very prominent; intermediate tubercles set far apart, each with two papillae close together at tip; dorsal tubercles normally placed; posterior stigmata high above middle line; spiracular plates twice the length of one slit apart, set at an angle, each directed upward towards the lateral borders of the segment, a shallow ridge being present on this outer margin of each plate; no lateral tubercles.

Posterior respiratory organ (Pl. XII, fig. 154) rather small; slits about five times as long as broad; slit walls as usual, with many crossbars and some irregular bridges; any surface teeth projecting into the slits always located near the ends, but many teeth at a greater depth more generally distributed; spindles noticeable; stigmatic chamber rather small and very narrow; reticulum with small and rounded meshes, only four or five across the narrow dimension; interspiracular processes large, needle-like fingers rather heavy, gracefully curved and much branched, seven to thirteen trunks with thirteen to twenty-five branches.

Recognition characters.—(1) The only band of spinules encircling the body is found on the first segment. (2) The external part of the anterior respiratory organ has exaggerated and deflexed lobe at each side. (3) The bifurcated intermediate tubercles lie above the middle. (4) The caudal segment is very smooth in this larva. (5) The posterior stigmata are placed in the dorsal third of the segment.

Dacus oleae (Rossi)

1790. *Musca oleae* Rossi, Fauna Etrusca, II, p. 317.

The "Olive fruit-fly" lives only in the fruit of the olive, but infests various species both of the cultivated and of the wild fruits. The maggot is of great importance in the Mediterranean countries, where its ravages appreciably lessen the crop of olive oil. Munro (1925, p. 43) states that it is probably indigenous in South Africa, since in that region, the wild olives have been found infested. It has also been reported from most of Africa, Europe, The Canary Islands and Western Asia. The eggs are deposited under the skin of the ripening olive and the maggots, feeding in the flesh, cause the fruit to wither and drop off.

Described from two specimens, lent by O. A. Johannsen of Cornell University.

Larvae small, elongate, 5 to 6 mm. in length by 1.5 mm. in diameter; rather narrow and elongate fusiform areas along all intersegmental regions.

Spinules present, of average size, heavy at base and set closely together in long, almost straight lines; narrow spinulose band on the anterior border of first segment, encircling the body; a narrow band likewise between first and second segments of the thorax, encircling the body; all other spinules confined to the fusiform areas.

Sensory papillae not seen in the preparations studied. Efflatoun (1927, p. 23, Pl. 3) figures the anterior and posterior sensory papillae. In his figures, the anterior is two-segmented, with basal segment as wide as long. Distal segment cone-shaped, slightly rounded at the tip and set on a small elevation, rising inside the rim of the basal segment; posterior sense papilla of one segment, wider than high, with narrowed extremity, bearing six very small straight-sided sensoria; stomal sense organs and guards not seen. Efflatoun lists the stomal ridges as ten to twelve in number.

Cephalo-pharyngeal skeleton (Pl. I, fig. 8) small, high and short in general outline; mouth hook slightly longer than hypostome and almost as deep as long, narrowly pointed distally; no subhypostomal sclerite, but long and prominent parastomals; remainder of skeleton about as deep as long; dorsal wing plates each with two long narrow projections from the ventro-caudal edge, not connected by the usual more lightly sclerotized parts; dorsal wings rising abruptly in a straight wall on the anterior border, four times as high as the hypostome.

Anterior respiratory organ (Pl. VI, fig. 53) small, external part fan-shaped, about twice as deep as wide and one and one-half times as deep as the stem; a long and narrow stigmatic chamber; reticulum with small irregular meshes, rectangular or hexagonal in shape and about seven stretching across the top of

one side of the chamber; tubules ten,[5] short, not much longer than wide, bulging near the rounded tip, half as long as stem.

Gross studies of the caudal segment were not made since the available material had already been mounted before the decision to include such descriptions in the paper.

Posterior stigmata (Pl. XII, fig. 155) small, the middle slits almost in a straight line with each other; posterior stigmatic plates set about three times the length of a slit apart and lying parallel to each other; slits small, about four times as long as wide, somewhat irregularly shaped but with no abrupt changes in direction of outline; several crossbars, but the writer's preparations show fewer of these than the figures of Efflatoun (1927, Pl. V); spindles large, crowding each other; atrial reticulum with moderately large and rounded meshes, five or six lying across the upper wall of the chamber; interspiracular processes prominent, with no basal pieces; fingers many-branched, needle-like but lying in graceful curves, six to ten trunks with thirteen to twenty-five branches.

Recognition characters.—(1) The unique feature is found in the cephalo-pharyngeal skeleton, which is small and in general shape about as high as long and with dorsal wing plates rising suddenly and high above the hypostome. (2) The spindles are crowded, the stigmatic lobes apparently somewhat larger than the outline of the chamber behind.

Efflatoun (1927, Pl. 5) figures another species of the genus, *Dacus longistylus* Wiedemann, which possesses a similar type of cephalo-pharyngeal skeleton, so it is not unusual in the genus. The two species differ radically, however, in the size and branching of the interspiracular processes. In *Dacus longistylus* Wiedemann there are two to six trunks and only three to nine branches.

Epochra canadensis (Loew)

1873. *Trypeta canadensis* Loew, Mon. Dipt. N. Amer., III, p. 235.

The "Currant fruit-fly" is a common pest of cultivated currants and gooseberries, and also of the flowering currant and wild species of the genus. It occurs in Maine, Manitoba, Montana, Colorado, Washington, Oregon and British Columbia. The species has also been taken in France where it almost certainly was introduced from America. The eggs are deposited in the fruits about the first of June in Maine (Harvey, 1896, pp. 5–6) and the larvae mature in about three weeks.

[5] Greene (1929, p. 493) cites this species as having seven to nine tubules, while Efflatoun (1927, p. 23) lists nine to ten.

Fruits often show many punctures and sometimes two or three flourishing individuals exist within a single currant. As soon as hatched, the larva begins to travel and may leave a light-coloured trail, immediately beneath the skin of the fruit. After traveling a third of the distance around the currant, the maggot burrows deeper and enters one of the seeds. As the insect feeds upon the contents of the seed, it soon grows too big to be comfortable inside. Then it lives in the pulp between the seeds, eating holes into the latter and devouring the contents. The frass, seed coats, etc. become cemented together, forming a black mass which is clearly visible through the skin of the fruit. When full grown, the maggot gnaws to the surface and cuts a roughly circular exit hole. Pupation takes place in the ground.

Described from a large number of specimens collected by A. V. Mitchener at Winnipeg.

Maggot elongate, small, 5 to 7 mm. in length by 1.5 mm. in diameter; seven fusiform areas noted in alcoholic material, the first one very small, all spinulose.

Spinules short and heavy with sharp tips; more conspicuous than in many species because of the extremely heavy circular bases; all lines long and only slightly curved; spinules in a wide encircling band of nine prominent lines on antero-dorsal margin of first segment; all intersegmental areas with spinulose bands, varying in width, two to four lines anteriorly increasing to thirteen to fifteen posteriorly; all bands encircling the body.

Anterior sense organs conspicuous, two-segmented, the whole papilla twice as long as wide, basal segment nearly twice as long as second, the first cylindrical, only slightly tapering distally, the second segment as wide as long, somewhat rounded at tip and smaller in diameter than the basal one; posterior sense organ as high as thick, slightly greater in diameter than the anterior sense organ, rim extending above the top with the apices of one or two sensoria showing slightly above the rim; stomal sense papillae present, but no guards; about seventeen stomal ridges of rather small size.

Cephalo-pharyngeal skeleton (Pl. I, fig. 10) of average size and like *Paroxyna picciola* (Bigot), with a heavy hypostome; mouth hook short and heavy, only slightly longer than wide and about as deep as the length of the hypostome; hypostomal sclerite twice as long as deep, with a heavy corner jutting down below the pharyngeal plates; subhypostome heavy and conspicuous; dorsal wing plate long and narrow with two projections of heavier chitin; a long narrow piece projects at upper end of the pharyngeal plates, distally branching for a short distance; pharyngeal skeleton at dorsal arch about twice as deep as hypostome; parastomals rather long and thin and lying close to the hypostome.

Anterior respiratory organ (Pl. VI, fig. 55) of average size, the stigmatic

chamber cylindrical; external part flaring abruptly, fan-shaped, gradually curving toward the somewhat higher middle portion; atrial reticulum only obscurely seen, of irregular small meshes; external part of organ one and one-half times as deep as the stigmatic chamber; the fourteen to sixteen tubules small, straight-sided, not at all crowded, about one-third as long as stem, somewhat more than twice as long as thick; outermost area of tubules with heavier granular appearance, but no indication of a clear spot around the spiracular openings.

The posterior view of caudal segment (Pl. IX, fig. 111) with some variations of note: the ventral tubercles with papillae placed as usual; laterals set well above the mid-horizontal line; dorsals quite close together, near the upper margin of the stigmatic area, but well removed from the dorsal margin of the specimen; an elongate depression on the middle vertical line, between but slightly above the dorsal papillae; the median and intermediate areas continuous across caudal end with no indication of divisions between; transverse depression cutting in from each outer edge but this depression not continuing more than one-sixth the distance across the area; tubercles on each side in the region thus cut off, close to the outer border; two prominent tubercles and papillae on each side of the intermediate region above the transverse depression; these three pairs of intermediate tubercles plus the ventrals so placed as to form a broad circle in the ventral half of the segment; spiracular slits placed high above the middle, well into the dorsal third of the aspect; posterior stigmatic plates about twice the width of one slit apart ventrally and slightly farther apart above; a diamond-shaped depression between the spiracular plates.

Posterior spiracles (Pl. XII, fig. 157) of average size; spiracular plates almost circular in outline; top of stigmatic chamber having heavier texture and color but no definite reticulum; no spindles; spiracular slits with abrupt changes of direction in outline, four times as long as broad; slit walls rather heavy but very irregularly outlined on the inner side, many weak teeth along inner rim and a few narrow crossbars; interspiracular processes rather small, three to four trunks dividing antler-like into seven to nine branches.

Recognition characters.—(1) Heavy spinules form a band around the first segment. A second narrow band encircles the body between the thorax and abdomen and a third between the two first abdominal segments. (2) The intermediate area bears an extra pair of tubercles on an area set off by a transverse furrow just above the ventrals. (3) The spiracular slits are evenly rounded at ends and abruptly curved away from the center of the plate. (4) The interspiracular processes bear characteristic antler-like branches.

Euaresta aequalis (Loew)

1862. *Trypeta aequalis* Loew, Mon. Dipt. N. Amer., 1, p. 86.

The "Cocklebur fly" is common in most parts of the country where its host plant is found. In late summer, when the seeds of the cockle-

bur are very minute, the adult lays her eggs. It has been thought that she lays one egg in a seed, but never deposits in both of the seeds which are enclosed in a common bur. The suggested reason for this is that the sheath is too hard to permit the escape of the mature fly later on. The uninfested seed germinates in spring and in so doing, breaks open the bur thereby liberating the insect in the companion seed. The wall between the two seed compartments is very thin and can readily be pierced by the adult after emergence. In examining a large number of burs, the writer found several with nearly full-grown larvae in both seeds of the bur. It is quite possible that this may not disprove the theory mentioned above, since a second adult may have laid an egg in a seed next an infested one. In northern Georgia, the larvae are full-grown by the first of March, since all of the many specimens studied on March 7th were already in that condition where the parts were beginning to shrink in readiness for pupation. When the burs were opened, practically all the meat had been eaten and a hole broken through to the companion cell. The maggot still remained inside the husk of the seed, along with bits of frass. Since cocklebur is only a weed and of no importance to man, this maggot is a useful rather than a harmful one.

Described from many specimens taken at Nacoochee, Georgia, by Richard Phillips in a patch of cocklebur from which many adults were taken the preceding autumn. The larvae collected on March 1, 1936 were assumed by the writer to be those of species named.

The larva is rather small, measuring about 5 mm. in length and 1 mm. in diameter; elongate, but somewhat rounded at each end; brownish although the meat of the cocklebur is nearly white in color; fusiform areas not distinguishable on the alcoholic material.

Spinules conical with heavy bases and the tips often recurved, rather small but numerous; lines quite strongly curved, but usually running into each other; most bands narrow, the widest ones found on the posterior part of the abdomen; no spinules on first segment, but a fairly wide band encircling the body at intersection of the first and second thoracic segments; next intersection with a narrow band of only two or three rows, followed by two other narrow ones; all bands encircling the body, those of abdomen being of nine to twelve lines in width.

The cephalo-pharyngeal skeleton so withdrawn inside the body that no study of the external head structure possible; cephalo-pharyngeal skeleton (Pl. II, fig. 11) rather distinctive, of average size; wings and pharyngeal plates flaring more than usual and about one and one-half times as long as the combined length

of hypostome and mouth hook; hypostome heavy and twice as long as wide, one and one-half times longer than the mouth hook; mouth hook about as deep as long, with a small secondary tooth near the tip of the hook; subhypostomal sclerite strong; no parastomals.

Anterior respiratory organ (Pl. VI, fig. 58) small, externally fan-shaped, almost flat distally, abruptly flaring; stigmatic chamber with rather small irregularly placed hexagonal meshes, nine to eleven across one side; external part about as deep as the cylindrical stigmatic chamber; tubules straight-sided, evenly rounded distally, nine to ten present, nearly half as long as the stem, each with a minute round, clear area at tip, surrounded by very heavy granules.

Even though the specimens are somewhat distorted, the posterior view of the caudal segment (Pl. IX, fig. 110) unique in appearance, wider than high, very smooth and rounded; all depressions very minute and papillae noticeable but not conspicuous; a circular area occupying the stigmatic, median and intermediate regions, marked off by a depression, in the trough of which are many deeper depressions, nearly equidistant from each other and slightly brownish in color; a pair of intermediate tubercles set closely together, almost directly below the posterior spiracles; all other tubercles, six in number, arranged in a semicircular line around the dorsal half of the stigmatic area, but this position not constant; spiracular plates set far apart, about eight times the length of a slit from each other, with dorsal ends much farther separated than the ventral; posterior stigmatic plates almost circular and somewhat sunken.

Posterior spiracles (Pl. XII, fig. 158) rather small; slits short and rounded, scarcely twice as long as wide; slit walls heavy with thin extremities; no teeth along inner edge of slit, although some irregularities in outline; spiracular plate not visible under the microscope but readily distinguished in gross view of the larva; stigmatic chamber large, with indistinct reticulum; interspiracular processes small, each finger widely lanceolate, two or three occurring in each group, rarely a finger with an apical notch, no branching.

Recognition characters.—(1) The spinules are placed in encircling bands. (2) The cephalo-pharyngeal skeleton possesses noticeably flared wings, heavy hypostome and an added small tooth on the mouth hook. (3) The posterior stigmatic plates are set far apart, with upper slits more distant from each other than the lower. (4) The oval spiracular slits show heavy non-toothed walls. (One specimen possesses a freakish formation in the posterior spiracle, which bears four slits on one side).

Eurosta comma (Wiedemann)

1830. *Trypeta comma* Wiedemann, Aussereur. Zweifl. Ins., II, p. 478.

The "Goldenrod root-gall fly" is not uncommon where its host, *Solidago juncea* Ait. occurs. However, the fly is often very limited

in distribution occurring in a very small area of a large stand of this goldenrod. In early summer, the adult deposits eggs in the roots near the surface. Apparently, the eggs are laid singly and when hatched, the young larva excavates an almost spherical cavity in the root into which it fits exactly. When full-grown, the maggot eats a tunnel to the outer surface of the gall, leaving only a very thin shell of epidermis between itself and the outside world, thus making emergence much easier for the adult. The gall is the same dark brown color as the root, but is rounded and rather smooth externally, while inside it resembles a potato tuber in quality and texture. This species may be synonymous with *Eurosta elsa* although Daecke had the two species before him when writing his original description of the gall maker.

Described from ten specimens taken by the author at Michigan Hollow, near Ithaca, New York, on July 19, 1927. Young larvae were also collected from the same locality on May 1st and others in October. Some galls were held over winter and the adult identified by the author as *Eurosta comma* (Weidemann).

Maggot is barrel-shaped, 8 mm. in length by 4 mm. in diameter; pearly white and with intersegmental lines running around the body in a changing zig-zag fashion; no fusiform areas visible in alcoholic specimens, but spinules on spindle-shaped patches of the body, readily seen under the microscope.

Spinules very minute when present, sometimes only a few in a limited area but this character apparently very inconstant since Benjamin, (1934, p. 28) states that the larvae are densely covered with minute spinules.

Anterior sense organs present, of a single cylindrical segment, distally truncated and about twice as long as thick; posterior sense organs almost as long as the anterior, but of twice the diameter and with eight to ten sensoria on distal end, arranged so as to give a convex profile to the tip; stomal sensory organs, guards, and stomal ridges all absent.

Cephalo-pharyngeal skeleton (Pl. II, fig. 12) small, wings widely flaring; hypostome rectangular in profile, one and one-half times as long as the mouth hook; no parastomals; subhypostomal sclerite conspicuous, rod-like; mouth hook slightly deeper than long, broadly convex above, the distal tooth very sharp with a second sharp tiny tooth and a third wide blunt one farther ventrad; dorso-posterior corner of mouth hook curved backward into a convex projection; pharyngeal plates with heavy prolongations of chitin running posteriorly.

Anterior respiratory organ (Pl. VI, fig. 56) very small; six or seven large tubules lying somewhat crowded across the top; meshes of stigmatic reticulum of two sizes, about eight large, almost square ones across the region near the tracheal trunk, and about fourteen rectangular ones farther distad; tubules bulging near the tip, but with no clear areas.

Caudal end (Pl. IX, fig. 113) unique, made up of concentric tumid rolls, with conspicuous depressions between; no tubercles or papillae present; posterior spiracles very small, set far above the middle transverse line; spiracular plates so far apart at dorsal ends that the six spiracular slits are almost in a straight line across the stigmatic area; spiracular plates about six times the length of one slit apart ventrally.

A minute study of the posterior spiracles (Pl. XII, fig. 159) showing a nearly circular spiracular plate with the stigmatic chamber somewhat larger than usual, its width much increased; reticulum of large irregular hexagonal meshes, four or five extending across the widest part; spiracular slits oval, not more than one-third longer than wide; walls fairly heavy but irregularly so, and in general as heavy at extremities as along the sides, a few weak teeth projecting into the slits, with an occasional, almost straight bar across the opening; no interspiracular processes.

Recognition characters.—(1) The anterior sense organs are composed of single segments. (2) The anterior respiratory organs are small, resembling a seven-fingered hand, externally. (3) The caudal end lacks tubercles and papillae. (4) The posterior spiracles are so placed that the six openings lie almost in a straight line across the stigmatic area. (5) The stigmatic slits are short-oval, with a few weak teeth and an occasional crossbar. No interspiracular processes are present.

Eurosta solidaginis (Fitch)

1856. *Acinia solidaginis* Fitch, Rept. Nox. & Benef. Ins. N. Y., 1, p. 67.

The "Goldenrod stem-gall fly" is a very common species in central New York state and when occurring in a field, is so plentiful that nearly every plant has one or two galls along its stem. Its distribution is limited by the range of the host, *Solidago canadensis* L. and it seems to occur wherever the plant is found. However, certain variations of the species occur and a race was found on other goldenrods which shows constant characteristics. The writer has considered these only varietal differences, however. During some seasons *Eurosta solidaginis* (Fitch) is very heavily parasitized. The Goldenrod stem-gall flies emerge in early spring, even before the young host plants are more than rosettes. Awaiting proper conditions for laying their eggs in the stems, the adults must live for some time before ovipositing. The galls are almost spherical and of a smooth surface texture. When cut open, a spherical cavity is observed in the center of the gall in which

the maggot lies. Apparently only one maggot lives in a single gall, but two galls often lie close together in the stem. Larvae taken on March 17, 1931 showed no tendency to shrink for the puparia, but that must take place very soon after this date, since the adults are often collected during the last of April or first of May. The full-grown larva eats a tunnel to the external edge of the gall, leaving only a thin partition for the adult to break through.

Described from a large number of specimens, collected in the vicinity of Ithaca, New York.

Larva barrel-shaped, pearly white, large and very like that of *Eurosta comma* Loew in general appearance, although slightly smaller; intersegmental lines of the same zig-zag pattern; no fusiform areas observed in alcoholic material.

Spinules very minute, needle-like and quite inconstant in arrangement, although sometimes grouped in a boat-shaped area. Three of the ten preparations studied, possessed no spinules at all.

Anterior sense organs present, rather large, about twice as high as broad, of a single segment, but with a pronounced collar around the distal margin rising above the rest of the structure; posterior sense organ heavy-walled, about as high as the anterior, but twice as broad as high, the outer rim forming an enclosure with ten to fourteen sensoria inside, somewhat resembling fence-posts, central ones rising slightly above the others; in some specimens, this sensory organ flattened and resembling a crescent-shaped hood, with the sensoria showing as dark stippling inside; stomal sense organs present in a few instances; no guards present; stomal ridges evident, indistinct, apparently forty to fifty on each side.

Cephalo-pharyngeal skeleton (Pl. II, fig. 13) small, wings widely spread; mouth hook small, widely arched on dorsal margin, about as long as deep, tip broadly rounded, with a pronounced blunt tooth on the lower edge; hypostome rather heavy, longer than the mouth hook; posterior border of the hypostome suddenly rising perpendicularly in front of the dorsal wings; subhypostomal sclerite very conspicuous, resembling a straight bar in profile; parastomals visible only as short splinters; pharyngeal plates with heavy bands of chitin extending posteriorly, spreading, but coming together again to form a loop; dorsal wings larger and longer than the pharyngeal plates, the anterior edge rising sharply above the hypostome. (This skeleton differs from that of *Eurosta comma* Loew in the form of its mouth hook. *Eurosta solidaginis* (Fitch) has blunt apical tooth and no sharp tooth on the dorso-ventral corner.)

External part of the anterior respiratory organ (Pl. VI, fig. 57) much resembling a hand, with the five fingers along the outer edge at the same level;[6]

[6] In fresh specimens which were dissected and mounted immediately after death, the resemblance to a short plump hand with wrinkles along the back where the joints occur, was even more pronounced. The darker colored bands at the tips of the tubules added to the illusion, since these areas looked like finger nails.

little more than the tubules projecting beyond the body surface; the stigmatic chamber long and narrow; in the region bordering the tracheal trunk, the meshes of reticulum very large, square in general outline, six extending across one side of the chamber; distal third of the chamber bearing a reticulum of minute meshes, fifteen to seventeen across one side; the somewhat spatulate tubules, four to five in number, about twice as long as broad, with a noticeable clear round area at tip of each, bordered by a wide band of heavy granular material, of a deeper yellow color.

The caudal end (Pl. IX, fig. 115) generally round and smooth; no tubercles nor papillae but only annular rolls in evidence; the stigmatic area triangular in outline, lying well above the mid-horizontal line and with the posterior stigmatic plates far apart, six times the length of one slit ventrally and about eight dorsally; spiracular plates almost round, conspicuous; three slits on one side almost parallel to each other, but making an angle of ninety degrees with those of the opposite side.

Stigmatic chamber (Pl. XIII, fig. 160) very large, almost circular as seen from posterior side; atrial reticulum with hexagonal meshes of average size; spiracular slits ovate, slightly wider at outer ends; slit walls heavy, with many short and sharp teeth, seven to fifteen on one side, but with a few bars extending across the opening from end to end; teeth only lightly sclerotized, but the wall heavy, consequently at first glance the slits appear to have no teeth; not all specimens possessing longitudinal bars in the slits, although most with somewhat similar long bars extending diagonally reaching nearly from end to end; bars lightly sclerotized and easily overlooked; in each slit wall near the outer tip, a small circular clear spot visible in all specimens; no spindles present; no interspiracular processes. (In some preparations rather curious structures were apparent, which have been figured chiefly to call the attention of other workers to them. Small spiral tubes seem to extend from the clear spaces in the outer extremities of the slit walls and apparently reach the surface some little distance away).

Recognition characters.—This species much resembles *Eurosta comma* Loew but differs in the following respects: (1) in the shape of the teeth on the mouth hook, (2) in the anterior respiratory organ which has four or five tubules instead of seven, (3) in the position of the posterior spiracular plates which lie at an angle of nearly ninety degrees to each other, (4) in the presence of bars which extend longitudinally through the slits.

Myoleja limata (Coquillett)

1899. *Aciura limata* Coquillett, Jour. N. Y. Ent. Soc., VII, p. 263.

This species lives in the berries of the holly and infests six species of the genus *Ilex* (Benjamin, 1934, p. 22). The puparium is formed in the ground. The fly is recorded from Massachusetts, Connecticut, Alabama and Florida.

Described from fifty to sixty specimens collected by F. S. Blanton at Altmore, Alabama, Oct. 31, 1932 in *Ilex decidua* Walt. and in the same locality from *Ilex vomitoria* Ait., in November of 1933.

Maggots small, about 5 to 6 mm. in length by 1.5 mm. in diameter; of the usual shape; the intersection between the first and second thoracic segments and all subsequent intersections of the body posessing spinulose fusiform areas.

Spinules confined to the fusiform areas; set very close together in long lines; broad-based but suddenly and sharply tapering to a point; bands sometimes rather wide, but containing only five or six widely separated lines of spinules; first segment lacking spinules.

Anterior sensory organ composed of three segments, basal one wide and flat, more than twice as wide as high, the second segment only half as wide as first and of about the same height, the third forming a globe set on top of the second and extending beyond its limits in all directions; posterior sensory organ about as thick as anterior, but twice as long with sides somewhat bulging and like many others, being composed of a heavily chitinized outer rim, surrounding the distal floor with its three straight-sided, elongate sensoria; no stomal sense organs, guards or stomal ridges seen in preparations examined.

Cephalo-pharyngeal skeleton (Pl. II, fig. 14) rather small; mouth hook about as long as deep, with slender, gently-curving, narrow-pointed tip; a conspicuous clear spot near center of the mouth hook; hypostome slender, not much longer than mouth hook, its ventral crossbar extending abruptly and conspicuously below the general outline; the subhypostomal sclerite likewise very noticeable, although only of average size; parastomals present but small, not heavily sclerotized; epistomal sclerite observed in many preparations and resembling that of *Rhagoletis pomonella* (Walsh); the dorsal wings longer than the pharyngeal plates. (The epistomium appears to have only one pair of clear spots, however, instead of two. In some slides this piece was doubled up and extended between the dorsal edges of the hypostome).

The anterior respiratory organ (Pl. VI, fig. 59) very different from all others studied, the external part flaring out suddenly, antler-like, producing high lateral lobes with a narrow connecting section, bearing many prongs on each side; nineteen to twenty-two tubules, varying a good deal in size and shape, all possessing a conspicuous clear drop at the apex, and this surrounded by an area twice the size containing heavy dark-colored granules; stigmatic chamber nar-

row and short, with three rows of small, rectangular meshes in its reticulum, twelve to fourteen across one side; indistinct, elongate, rectangular meshes in irregular rows all along the proximal edge of the external part; greatest width of the spiracular organ more than the depth.

The caudal segment (Pl. IX, fig. 114) generally rounded in outline, papillae prominent and sharp; posterior stigmata set far above the middle, well into the dorsal quarter of the segment, close together; ventrally, the stigmatic plates not the length of one slit apart but dorsally somewhate farther separated; stigmatic area raised, the surroundings falling away sharply; two pairs of dorsal papillae on margin and somewhat farther apart than the stigmatic plates; ventral area very high and wide with a single pair of tubercles near the dorsolateral corner; intermediate area in one piece with two pairs of tubercles, one pair close to the border of the stigmatic area, slightly farther apart than the spiracular plates, the second pair lying ventro-laterad of the first, an interrupted circle of brown color lying in the outer third of the region. (This is not shown in the figure as it would give the impression of interrupted depressions).

Spiracular plate (Pl. XIII, fig. 161) large, circular, with the slits long and narrow, lying sub-parallel; upper wall of stigmatic chamber small, narrow and elongate, the meshes in the reticulum small, hexagonal and about nine units across its narrowest part; narrow spindles present; slit walls very heavy with numerous blunt teeth projecting about one-fourth across the opening, fourteen to nineteen along one side; interspiracular processes large and showy, each with a basal crescent, the basal piece being translucent rather than dark as is that of the genus *Neaspilota;* each process wide-spread and feathery, of from nine to fourteen trunks and eighteen to thirty-four branches; individual fingers spreading out and almost touching each other, about half the length of the slit.

Recognition characters.—(1) The anterior sensory organ is three-segmented. (2) Externally, the anterior respiratory organ is antler-like, of nineteen to twenty-two tubules. (3) The posterior stigmata are placed in dorsal fourth of the last segment. The ventral area is very wide and high. An interrupted circle of brown color lies around the outer quarter of the segment. (4) The interspiracular process is large, feathery and showy, nine to fourteen trunks with eighteen to thirty-four branches, with a clear basal crescent piece.

Neaspilota achilleae Johnson

1900. *Neaspilota achilleae* Johnson, Entom. News, XI, p. 328.

This species is doubtless indigenous in North America. It was described by Johnson in 1900, having been taken on *Achilleae millefolium* L., hence the name. Benjamin (1934, p. 37, fig. 26) described and figured the immature stages which he collected rather commonly on

many species of Compositae, each larva feeding singly in the flower head. The maggot fits snugly into the base and feeds on the developing seeds, not living inside a single seed but eating through the whole closely set group. It is of little economic importance, since its host plants are mostly weeds.

Described from seven specimens, taken at Islip, New York on *Heracleum* sp. by F. S. Blanton, June 30, 1931.

Larvae are about 3.2 to 3.8 mm. in length and 1.5 mm. in diameter; elongate; no fusiform areas noticeable either on alcoholic material or on the mounted preparations.

A rather smooth maggot, with a stippling of fine granular spinules, not uniformly set over the entire surface and not constant in distribution; spinules minute, rounded apically.

Anterior sense organs single-segmented, small, about as wide as long with a collar at tip; posterior sensory organs slightly thicker than long and about the same length as the anterior, consisting of a heavy piece surrounding some four or five peg-like sensoria which rise distally to about the same height as the collar; no stomal sense organs, guards, or stomal ridges.

Cephalo-pharyngeal skeleton (Pl. II, fig. 15) small, slender and delicate, the wings lying almost parallel to the pharyngeal plates; mouth hook rather heavy, dorsal edge strongly arched, the tip itself narrow and pointed, with a tooth on the ventral edge, set well back from the distal limit; mouth hook longer than deep about the length of the hypostomal sclerite; hypostome long and narrow, not more than one-fourth as deep as long; subhypostomal piece very strong and prominent and more than half as deep as the hypostome; no parastomals seen.

Anterior respiratory organ (Pl. VI, fig. 60) small, somewhat resembling a shamrock leaf, the three tubules each somewhat spatulate near the tip and with the apical third occupied by dark and heavy granules;[7] the remainder of the respiratory organ uniformly granulate, with no reticulum in chamber; anterior respiratory organ about as long as wide and quite constant in all the preparations.

Caudal end (Pl. X, fig. 116) very smooth, with no tubercles and no papillae; stigmatic area somewhat sunken, set far above the middle with a sharp overhanging precipice bounding its entire margin; spiracular openings small and inconspicuous in general view, those on left side lying about five times the length of one slit from the others ventrally and seven dorsally; no spiracular plate seen in general view; caudal segment bearing spinules similar in appearance to those along the sides of the body.

Spiracular plate (Pl. XIII, fig. 162) orbicular with the elongate stigmatic chamber regular in outline; slits usually more or less straight-sided; slit walls fairly heavy, with no crossbars, but from one to six short inconspicuous teeth

[7] Benjamin (1934, p. 37) gives number of tubules as three to four.

along one side of the slit; interspiracular processes far removed from the slits, each with a heavy and noticeable crescent-shaped basal piece, with a circular clear spot inside the arms of the crescent, each with six to twelve narrow, lanceolate fingers, branches very rare.

Recognition characters.—(1) The cephalo-pharyngeal skeleton is slender and long, with conspicuously heavy subhypostomal sclerite. (2) The anterior respiratory organ bears three tubules, their arrangement resembling that of a clover leaf. (3) No tubercles or papillae are found on caudal segment. (4) Blunt spinules are present on caudal segment. (5) Interspiracular processes appear set well back from slits, with very narrow, lanceolate fingers, almost never branched.

Neaspilota albidipennis (Loew)

1861. *Trypeta albidipennis* Loew, Berl. Ent. Zeit., v, p. 345.

This species has been taken in Pennsylvania, New Jersey, Massachusetts and New York, but certainly does not occur everywhere its host, the ironweed is found. The maggots feed singly, each occupying the base of one of the small heads and there eating the developing seeds of the host plant. When fully grown, larva is too large to live inside a single seed and evidently eats through the sides of many seeds during its growth.

Described from two specimens collected by F. S. Blanton at Babylon, New York, August 15, 1933, in flowers of *Vernonia noveboracensis* Willd.

Larva small and showing the usual general shape and color; 4.5 mm. in length and slightly more than 1 mm. in diameter; no fusiform areas discernible.

Spinules small, mostly pointed backward with globular bases; four or five wavy but continuous rows of spinules on the anterior area of the first segment, forming a wide band; other spinulose bands found near intersegmental lines throughout the body; although the spinules often scattered uniformly through the band, wavy rows very often occur, rows quite reminiscent of the lines seen in many species, but here running into each other.

Anterior sense organs present, but very minute, single-segmented, globular with narrow collar around distal end, which is pinched into a circumference much less than that of the middle of the segment; posterior sense organs likewise small, of about the same diameter as the anterior organs, but somewhat longer, heavily sclerotized walls enclosing three or four long and narrow, straight-sided sensoria, rising slightly above the outer wall; no stomal sense organs or guards; no stomal ridges.

Cephalo-pharyngeal skeleton (Pl. II, fig. 16) small but heavier than that of *N. achilleae* John., very similar to that species but with extra tooth on mouth hook and heavy conspicuous subhypostomal piece; no parastomals; dorsal wings and pharyngeal plates of about equal length; antero-dorsal area of dorsal wing prolonged forward into a sharp corner.

External part of the anterior respiratory organ (Pl. VI, fig. 61) with seven or eight tubules, rather elongate and set on the body at a slight angle;[8] tubules set close together, slightly flared, and noticeably bulging near the distal third, flattened distally, with a thimble-like clear space on each; stigmatic chamber wider than deep, with a double row of large, globular meshes, one to four of these across one side; depth of stem equalling the combined depth of chamber and tubule, but only half as thick as deep.

Caudal end (Pl. X, fig. 117) smooth, with very slight depressions, and perceptible but small tubercles; the stigmatic area sunken but flat, lying on the middle transverse line; spiracular plates not very conspicuous, lying rather close together, separated only by two or three times the length of one slit at bottom and four times the slit length at dorsal border; two pairs dorsal tubercles, far below the dorsal margin of the segment; three pairs of tubercles lying in the lateral region, two close together near the usual location and a third pair far ventrad, on a line running between the intermediates and ventrals; a single pair of intermediates directly below the spiracular plates and a pair of ventrals, below the intermediates; a straight line drawn through the dorsal tubercles and the middle spiracular opening when continued, falls also on the intermediate and on the ventral tubercle of that side.

Spiracular plate of the posterior stigmata (Pl. XIII, fig. 163) large, elongate, smoothly oval in outline; top of the stigmatic chamber kidney-shaped and with a small number of large circular meshes in the reticulum, only three of these meshes across the narrow diameter; spiracular slits ovate, wider at the outer ends; slit wall very heavy and smooth in outline, having four or five crossbars or sometimes four or five sturdy teeth along each side; no spindles; interspiracular processes similar to those of *N. achilleae* John. and like them, with basal crescents to which fingers are attached, but in this species no clear spot enclosed by the crescent; fingers needle-like, four to six in number; no branches; two middle interspiracular processes set between the slits, while the other two are placed well back as in the other species of the genus.

Recognition characters.—(1) The spinules are arranged in encircling bands of wavy, continuous rows. (2) The anterior respiratory organ bears seven to eight tubules, which are flattened distally. (3) The caudal end has many small distinct tubercles, including three pairs of laterals. (4) The slit wall is very heavy, the thickness of the two

[8] Doubtless this angle is exaggerated in the figure because of distortion by the cover glass. Alcoholic specimens show narrower angle.

walls equalling the width of the opening itself. (5) Each interspiracular process has a basal crescent, which gives off four to six straight needle-like unbranched fingers.

Paracantha culta (Wiedemann)

1830. *Trypeta culta* Wiedemann, Aussereur. Zweifl. Ins., II, p. 486.

This species has been reported from Mexico, Central America, South America, from the Pacific states, Carolina, Florida, Idaho, South Dakota, New Mexico, Kansas and Georgia. Benjamin (1934, p. 30) questions the accuracy of these records, suspecting many refer to another closely related species. Larvae feed in the bases of the flowers of thistle, possibly getting nutriment from the seeds, as do many other Compositae-loving species. From one to twelve have been found in a single flower head and occasionally larvae may be feeding in the tender growing stems.

Described from two specimens lent by the United States National Museum, collected in Orlando, Florida, on April 6, 1931, by Nicholson and determined by C. T. Greene. Taken on *C. spinosissimus* (Label reads *Carduus spinosissimus,* while Benjamin (1934) calls it *"Cirsium spinosissimus,* a thistle").

Larvae barrel-shaped, 6 to 7 mm. in length and 3 mm. or more in diameter; no fusiform areas present.

Individual spinules rather large, sharply cone-shaped, the sides of the cones being concave, thus achieving a sharper spinule; almost innumerable spinules on the body, in wide bands nearly touching each other; spinules not placed in rows or lines as is usual, but spread uniformly over the spinulose area.

Anterior and posterior sense organs not found. No stomal sense organs, guards or stomal ridges.

Cephalo-pharyngeal skeleton (Pl. II, fig. 17) of average size, heavily colored and sclerotized; mouth hook small, sharply recurved at the tip, slightly longer than deep; hypostome small, elongate and narrow, two and one-half times longer than deep, ventral bridge of hypostome barely showing below the rest of the sclerite; subhypostome evident, but not especially heavy; parastomals present, seemingly attached to the main pharyngeal skeleton rather than to the hypostome; at dorsal arch, pharyngeal skeleton not twice as deep as the hypostome, but the dorsal wing curved high beyond the arch and extending farther caudad than usual, two and one-half times as long as the combined length of the mouth hook and the hypostome; pharyngeal plate with a large spindle-shaped hole in the middle.

Anterior respiratory organ (Pl. VI, fig. 62) rectangular in outline, with eight to ten tubules scarcely spreading; tubules rather crowded along the top and each flattened apically and with a crescent-shaped clear area occupying the distal end; rather wide band of heavy granules just proximad to the clear space; only a small part of the respiratory organ external, three-fourths of it being taken up by the stigmatic chamber; reticulum with nearly circular meshes, some twelve to fourteen across one side; chamber quite noticeably wider than deep.

In posterior view (Pl. X, fig. 118) the last segment appears made up of tumid rolls, very much resembling other species of the barrel-shaped type; the small stigmatic area sunken, its ventral edge about on the transverse mid-line, the spiracles nearly filling it; no spiracular plate visible in gross examination, but perceptible in the preparations; no tubercles nor papillae; spiracular plates about three times the length of one slit apart, the group of spiracles on left side about parallel to that of right; a wide band of scattered spinules surrounding the stigmatic area.

The spiracular plate (Pl. XIII, fig. 164) rather large and kidney-shaped; distal end of stigmatic chamber larger than the average, narrowly kidney-shaped; marginal band of radiations wider than usual, the reticulum with circular meshes, about five across the narrow diameter; spindles very narrow, with slits likewise very narrow, only one-fifth as wide as long; outline of slit wall bulged and constricted into a series of regular scallops; slit wall weak with no crossbars, but six to fifteen rather prominent heavy teeth along each side; interspiracular processes smaller than the average and little spread distally, five to eleven trunks apparent and thirteen to fifteen branches, with divisions distad to the basal fourth, the entire process appearing stiff and inflexible.

Recognition characters.—(1) The body is barrel-shaped. (2) The anterior stigmatic chamber appears almost square in outline with eight to ten uncrowded tubules. (3) Neither tubercles nor papillae are found on caudal segment, but many spinules are arranged in a wide encircling band about the stigmatic area. (4) The spiracular slits are long and narrow, one-fifth as wide as long, with weak walls possessing teeth. (5) The fingers of the interspiracular processes are arranged in stiff tufts, which are composed of small groups of from five to eleven fingers fully half as long as the slits.

Paroxyna picciola (Bigot)

1857. *Acinia picciola* Bigot, in Sagra, Hist. Phys. Pol. Nat. Cuba, p. 824.

This species is not known to be of economic importance but it is a widely distributed inhabitant of various flowers of the Compositae. It is found wherever its hosts grow in the New World.

Described from eight specimens, collected by F. S. Blanton at Sulphur Springs, Louisiana, Sept. 26, 1930.

A minute species, 2.5 mm. in length by .8 mm. in diameter; general view of alcoholic specimens showing no distinct fusiform areas; many wrinkles around the venter of the abdominal region.

Spinules minute, and chiefly noticeable in face view, where they resemble stippling; in profile very short and small, scarcely perceptible under the microscope, not occurring in lines, but uniformly placed within the area of the spinulose band; spinules common on the body in the following areas: a few on the first segment; a very narrow band on the next three intersections and increasingly wider bands along intersegmental lines throughout the abdominal region; all spinulose bands completely encircling body except the one on the first segment; in the abdominal area, bands so wide that some practically touch on the dorsal side, although not on the venter.

Anterior sense organ very small, of a single cylindrical segment, with a somewhat larger collar at top; the straight-sided posterior sensory organ longer than the anterior organ and with three or four sensoria set within the rim and rising to the level of the distal margin; stomal sense organs, guards and stomal ridges all lacking.

Cephalo-pharyngeal skeleton (Pl. I, fig. 9) small but heavily built; hypostome very heavy and large, somewhat longer than the mouth hook and nearly one half as deep; subhypostomal sclerite heavy and prominently jutting out from under a projection of the ventral edge of the hypostome; mouth hook slightly deeper than long and with short distal end, recurved slightly near the tip; dorsal wings and pharyngeal plates not much longer than the hypostome plus the mouth hook, while the depth at the dorsal arch is not twice that of the hypostome; parastomals absent; pharyngeal plate with a conspicuous hole through the caudal end, the more heavily sclerotized projections clearly coming together again posteriorly.

Anterior respiratory organ (Pl. VI, fig. 54) small, externally nearly straight-sided, with four or five tubules; no atrial reticulum discernible, the entire region of the organ being granular in appearance; tubules nearly twice as long as thick, with sides only slightly bulging near tip, about three-fourths as long as the rest of the external part.

Caudal end (Pl. IX, fig. 109) appearing rounded and smooth in profile, but in the posterior view, somewhat resembling a series of rings of varied sizes, set inside each other, with deep depressions between; in the dorso-lateral area, a heavy depression cutting part way through the annulus beyond the stigmatic area; the spiracular plates set far above the mid-horizontal line, small, only about the width of one slit apart ventrally, but more than twice as far removed dorsally; no tubercles nor papillae present.

Posterior spiracles (Pl. XII, fig. 156) unique, slits no more than twice as long as wide, each somewhat spatulate in shape, decidedly wider on inner end;

slit walls extremely thick, except across the outer ends and there almost disappearing; no teeth or crossbars, only a few undulations appearing on the inner edge of the slit; stigmatic chamber small, with large irregular hexagonal meshes, only four stretching across the widest part of the upper wall; interspiracular processes small, made up of two to four lanceolate unbranched fingers.

Recognition characters.—(1) The anterior sense papillae are single-segmented. (2) No stomal ridges are apparent. (3) The spinules are scattered uniformly over the spinulose bands and not set in rows. (4) No tubercles nor papillae are seen on the posterior view of the caudal segment. (5) The spiracular slits are wide, with heavy walls but no teeth or crossbars projecting into the slit.

Procecidochares atra (Loew)

1862. *Trypeta atra* Loew, Berl. Ent. Zeit., VI, p. 219.

This species has been taken in New York, Georgia, Utah and Nova Scotia. It inhabits galls of various species of goldenrod. Felt (1918, pp. 193, 198) lists it from small apical rosette galls of *Solidago altissima* L. and from lateral bud galls of *Bigeloviae graveolens* Gray. Aldrich (1929, pp. 8-9) states that it lives in leafy rosulate galls on *Solidago nemoralis* Ait. and also that he reared it from *Chrysothamnus* in Utah.

The two specimens studied were taken from goldenrod galls by F. S. Blanton.

The maggots are small and stout, barrel-shaped in general view, about 4 mm. in length and 2.5 mm. in diameter, the measurements being made of mounted specimens.

No spinules present; no indications evident of the sensory organs of the head; no guards and no stomal ridges.

Cephalo-pharyngeal skeleton (Pl. II, fig. 18) slender and not very heavily sclerotized; width about equal to length; dorso-proximal corner of the mouth hook very sharply pointed; mouth hook itself sharp apically with one or sometimes two distinct teeth along the ventral margin; hypostome long and narrow, longer than the mouth hook and more than three times as long as wide; subhypostome narrow, perhaps broken off in preparation; pharyngeal plate with a boat-shaped hole through the middle; dorsal wings large, with several long splinters of the darker chitin extending backward, wings rising very gently and gradually from the hypostome, with no indication of a projecting corner near the dorsal arch; no parastomals.

Anterior spiracles (Pl. IV, fig. 63) on mounted specimens appearing very much like posterior stigmata, with five broad and short openings, these surrounded by heavy walls with wavy indentations on the inner margins; stigmatic chamber shallow but of rather wide diameter; no reticulum visible.

Spiracular plate (Pl. XIII, fig. 165) sub-orbicular, distal wall of stigmatic chamber kidney-shaped in outline, with narrow region of marginal radiations; reticulum with large, almost square meshes, only four extending from side to side of the shorter diameter; prominent rounded spindles present; spiracular slits short and wide with exceedingly heavy walls, entire structure not quite twice as long as wide; no crossbars and only slight suggestions of wavy projections instead of teeth along inner edges of slit walls; interspiracular processes present, each consisting of a single conical finger and all set within the boundary of the distal wall of the stigmatic chamber.

Recognition characters. (1) No spinules are present. (2) The delicate cephalo-pharyngeal skeleton has long narrow hypostome and no parastomals. (3) The anterior respiratory organs bear five spiracular openings which resemble the posterior stigmata.

Procecidochares australis Aldrich

1929. *Procecidochares atra* var. australis Aldrich, Proc. U. S. Nat Mus., LXXVI, (2), p. 9.

The maggots of this species live in galls in young shoots of woody stems of flowers of *Heterotheca subaxillaris* (Lam.) Britton & Rusby and *Erigeron pusillus*. This species was originally described from Waco, Texas, but now is known to be fairly common in Florida (Benjamin, 1934, p. 23). Galls are more or less hidden by bunches of small leaves attached to part of the gall, or are tucked away in the flowers. Often, the galls are very small, enclosing a single larva, but again they may contain two to eight larvae. Six or seven galls may be present on a single plant.

Described from two specimens, collected at Orlando, Florida, by D. J. Nicholson, May 9, 1931 and lent to the author by the United States National Museum.

Maggots small, 5 to 6 mm. in length by 1.5 mm. in diameter; somewhat barrel-shaped, marked on the dorsum by a dark brown blotch, which extends over an irregular area on the fourth, fifth and sixth abdominal segments, with a small separate island of color in the middle of the dorsum of the third abdominal segiment; very smooth larvae with no spinules perceptible anywhere on the body; slightly wrinkled in the ventral region near the intersegmental lines.

Anterior and posterior sense organs both present, but flattened on slides so that only the transverse view is apparent; posterior organ of larger circumference than the anterior and with five or six sensoria; no stomal sense organs, guards or ridges evident.

The cephalo-pharyngeal skeleton (Pl. II, fig. 19) very heavy and dark; mouth hook resembling a gauntlet with a long, spreading cuff, and possessing a dorsal corner which curves backward above the hypostome into a sharp point; mouth hook a little longer than deep, with the dorsal outline gently arched, but with a very rounded and blunt distal tip; a prominent tooth on the ventral border about half way between tip and the abrupt flare of the base; hypostome larger than mouth hook and at union with pharyngeal plate, fully as wide as the mouth hook, slightly longer and rectangular in shape, giving a much more massive appearance; subhypostome very heavy, long and conspicuous; dorsal wing rising only a short distance above the deep hypostome; pharyngeal plates heavily sclerotized, with only small area of lighter material; no parastomals.

Anterior spiracles (Pl. VI, fig. 64) very peculiar; large oval openings, three in number, in each respiratory organ, much resembling the posterior spiracles and with heavy encircling walls;[9] stigmatic chamber large, both wide and deep, with a large reticulum of circular meshes, only four or five across one side; distal wall of anterior stigmatic chamber of very similar construction to that of the posterior stigmatic chamber, narrow radiating striations near the outer margin, but no meshes evident in face view.

The caudal segment (Pl. X, fig. 119) smooth and rounded throughout; the ventral border of the stigmatic area almost exactly on the mid-line; stigmatic area wide and short with the posterior spiracles ten times the length of one slit apart ventrally and much more distant dorsally; immediately below and touching the ventral edge of the stigmatic area, a wide but short area marked off by a depression line; no tubercles or papillae on the caudal segment.

Spiracular plate (Pl. XIII, fig. 166) small, nearly orbicular; stigmatic chamber large, short and thick, somewhat kidney-shaped, marginal area of radiating lines very wide and the reticulum of the chamber with large, circular meshes only slightly crowded, four or five across narrowest diameter; spiracular slits short, ovate, wider at the outer side; slit wall very heavy, with no crossbars or definite teeth, but a few undulations along inner margin; interspiracular processes characteristic of the genus, each consisting of a single small, cone-shaped finger, three of these situated as usual near the slits, the fourth far removed, on the margin of the spiracular plate; no spindles showing.

Recognition characters.—(1) No spinules are present. (2) The anterior respiratory organs possess three oval openings, which very much resemble the posterior stigmata. (3) The cephalo-pharyngeal

[9] Benjamin (1934, p. 23) gives anterior respiratory organs as being composed of two or three tubules each which (fig. 17, c–d) jut out suddenly from the body wall. They are truncated distally.

skeleton is very massive and heavily sclerotized, possessing an extra tooth on the mouth hook, extremely large hypostome and very conspicuous subhypostomal sclerite. (4) No tubercles or papillae are seen on the caudal segment. The posterior stigmatic plates make a wide angle with each other. (5) Spiracular slits are short and wide. Including the heavy walls, each slit is scarcely twice as long as wide. Interspiracular processes consist of a single small conical finger each. (6) The presence of a dark brown blotch on the dorsum of the maggot is quite characteristic of this species.

Rhagoletis berberis Curran

1932. *Rhagoletis berberis* Curran, Amer. Mus. Nov., no. 526, p. 8.

The fly was first recognized when reared by S. C. Jones in Oregon, from berries of the Oregon grape *(Berberis nervosa)* in the Hood River region.

Described from a large number of specimens, collected by Jones at Shaw, Oregon, August 30, 1931.

Larvae rather small, white, of usual shape; 4 to 6 mm. in length and 1 mm. in diameter; fusiform areas perceptible even to the naked eye.

Spinules rather large, short and pointed, widely spaced in slightly curved lines; a single short row near intersection of prothorax and mesothorax, running across venter and only a short distance up the sides; bands along the venter of all subsequent intersegmental lines and confined to the fusiform areas; first two or three spinulose areas very narrow and inconspicuous but areas widened posteriorly to include seven to ten rows along abdominal region; often no bands encircling the body at all, sometimes one or two lines on dorsum only, some specimens with narrow encircling bands anteriorly.

Anterior sense organs two-segmented, basal one almost orbicular with the second as long as the first, of little more than half the diameter, but longer than thick, smoothly rounded distally; single segment of the posterior sensory organ as high as combined segments of the anterior organ and nearly twice its diameter at base, sides approaching each other distally, enclosing a sunken apical surface only half as great in diameter with four or five peg-like sensoria; stomal sense organs and guards present; stomal ridges not always discernible, only four weak ones seen on any specimen.

Cephalo-pharyngeal skeleton (Pl. II, fig. 20) closely resembling that of *Rhagoletis pomonella* (Walsh) but with dorsal wings and pharyngeal plates somewhat longer in proportion to depth and with a sharp tip jutting downward near dorsal arch; subhypostome very narrow and hidden from lateral view.

Anterior respiratory organ (Pl. VI, fig. 65) with narrow chamber, suddenly spreading at surface into eight to ten tubules, the outer ones lying almost

parallel to body surface; tubules rather large, not twice as long as their diameter and with heavy granular region occupying almost entire tubule; no signs of external openings; reticulum of chamber made up of small circular meshes, about nine across one side.

Posterior view of caudal end (Pl. X, fig. 120) strongly furrowed, the rolls and depressions prominent but the tubercles inconspicuous; usually the stigmatic area definitely closed at the sides in this genus, but in this species and in *R. juniperinus* Marc. open laterally; usual tubercles present; dorsals set farther apart than the posterior stigmatic plates and below the dorsal margin; lateral papillae in line with the ventral pair of slits and not touching the margin; intermediate tubercle bifid and ventrals lying in a straight line below the posterior spiracles; posterior stigmata scarcely above the middle horizontal line, and about four times the length of slit apart, but somewhat spreading dorsally.

Posterior stigmata (Pl. XIII, fig. 167) of usual size, spiracular plate suborbicular; rather wide and heavy-walled slits, two and one-half to three times longer than wide; walls with many teeth, ten to twelve on one side, and two to four interlocking crossbars; interspiracular processes fully half as long as the slits, each with two to four wide trunks with several branches in outer third, the whole stiff and ungraceful in appearance.

Recognition characters.—(1) The eight to ten tubules are longer than in *R. pomonella* (Walsh). (2) No stomal ridges were found in most specimens although sometimes one or two weak ones may be seen. (3) The interspiracular processes are half as long as the slits and possess heavy trunks, with stiff branches in outer third. (4) The stigmatic area is open laterally.

Rhagoletis cerasi (Linnaeus)

1758. *Musca cerasi.* Linnaeus, Syst. Natur., (10), p. 600.

For over a hundred years this species has been recorded infesting cherries in Europe. Apparently, it has never become established in this country, although often taken by inspection officers in cherries shipped from abroad. The habits of the species are very similar to those of the North American cherry flies. The eggs are laid just below the skin of the fruit and the young maggots tunnel directly to the stone in the center. There they feed in the pulp around the pit. When the cherries fall to the ground, the maggots escape and pupate a few inches below the surface. The species has been reared from a large number of host plants.

Described from four specimens taken at New York City in cherries from Italy and identifed by C. T. Greene. They were lent to the author by the United States National Museum.

Larvae of usual size and shape; eight fusiform areas readily perceptible on alcoholic material.

Spinules very slender and sharp with long curved tips, ten to sixteen set rather close together in long and only slightly wavy lines; a few lines, sometimes only one, along ventral intersegmental area between prothorax and mesothorax, but sometimes encircling the body; the next two intersegmental lines with sparsely spinulose encircling bands; all other spinules on body confined to the large fusiform areas, the broader spinulose bands being wider than the regions between them, often eight to ten lines in width.

Anterior and posterior sense organs similar to those of *Rhagoletis berberis* Curran; guards and stomal sense organs present; no stomal ridges seen.

Cephalo-pharyngeal skeleton (Pl. II, fig. 21) with slender mouth hook and hypostome; comparatively large wings and pharyngeal plates; hypostome rectangular, more than twice as long as deep in side view; combined length of mouth hook and hypostome about three-quarters the length of dorsal wing; subhypostome clearly perceptible from above.

Anterior respiratory organ (Pl. VI, fig. 66) with narrow, almost straight-sided chamber and broad but low external part, with about fifteen tubules; stimatic chamber only a quarter the width of the external part; tubules not crowded, half as long as stem, evenly rounded at tips and each with a circular, clear area at center of outer end; a tube running down through the axis of the finger; reticulum with small, circular meshes about seven across chamber.

Posterior view of caudal segment (Pl. X, fig. 124) very wrinkled and lined, the depressions deep and the raised portions very prominent; stigmatic area about as usual, but the spiracular plates raised and tilted toward the center; a wide annulus surrounding the stigmatic area, and within this raised area various depressions and tubercles; dorsal tubercles almost directly above the stigmata, half way between the stigmatic area and dorsal margin; two pairs of laterals, one set on lateral margin, slightly above the stigmata and the second lower and nearer to the spiracles; two pairs of intermediate tubercles, one pair far apart and the inner ones sometimes bifid; no definite division between ventral and median areas; ventral tubercles widely separated.

Posterior stigmatic plates (Pl. XIII, fig. 168) only slightly turned away from each other dorsally, the middle slits on each side about in a straight line with each other; interspiracular processes more than half as long as slits, five to seven trunks with most of them branching once, beyond the middle; slits about four times as long as wide, with ends evenly rounded; slit walls narrow, with many long teeth projecting into the opening; usually no crossbars apparent at surface, but many such observed upon focusing deeper; twelve to eighteen teeth along one side of the slit; spindles prominent; reticulum with many small circular meshes, eight across top of chamber.

Recognition characters.—(1) Spinules are usually confined to the fusiform areas, but along the first three intersegmental lines are some very narrow encircling bands. (2) Cephalo-pharynegal skeleton has narrow, small mouth hooks and hypostome. (3) The anterior respiratory organ bears about fifteen tubules. (4) The posterior view of the caudal segment possesses an encircling wide roll, outside the stigmatic area, with many short depressions, which cut part way through from the outside.

Rhagoletis completa Cresson

1929. *Rhagoletis suavis* subsp. *completa* Cresson, Trans. Amer. Ent. Soc. LV, p. 412.

Since this was originally described as a subspecies of *Rhagoletis suavis* (Loew), the comparisons shall all be made with that species instead of with the apple maggot, as in the case with other members of the genus. It is apparently indigenous in the southern central States. Outside of California, it has never been taken in any fruit except the Wild black walnut. In California, however, the species attacks all varieties of Persian walnut, as well as other species of *Juglans*. The Walnut husk fly *(Rhagoletis completa* Cresson*)* will also go over into peach orchards if situated nearby, and live in that fruit. The behavior and life history are very much like those of *Rhagoletis suavis* (Loew). About fourteen eggs are laid by one female through a single deposition hole and there placed in a compact cluster just beneath the skin. The female always oviposits in healthy tissue, never using old holes or prepared punctures. A drop of fluid oozes out of the walnut after the puncture is made, and both males and females will imbibe it freely. The drying fluid leaves a black stain. Before very long a brown spot shows externally over the broken tissue around the eggs. Further, there is a "Tear stain" evidence on the outside of the husk, which helps to indicate infested fruit. The larvae hatching from a single batch of eggs seem to live near each other but they make individual tunnels. When full-grown, they often leave the fruit through the puncture made by the female in egg-laying. They pupate in the ground and only rarely inside the husk.

Described from many specimens bred by Boyce in southern California, from Eureka walnuts and collected Sept. 9, 1930. The larvae are of about the same size as those of *Rhagoletis suavis* (Loew).

The very minute spinules confined to the fusiform areas instead of being placed in encircling bands as in *Rhagoletis suavis* (Loew); a few rows of spinules on antero-dorsal half of border of first segment.

The anterior, posterior and stomal sensory organs all present; stomal ridges only seven in number; guards with a single tooth each, instead of two.

The cephalo-pharyngeal skeleton (Pl. IV, fig. 31) similar to that of *Rhagoletis suavis* (Loew), but the mouth hook much smaller in comparison with the hypostome; the curve of the anterior edge of the dorsal wing scarcely as deep and the wings longer and wider.

The anterior respiratory organ (Pl. VII, fig. 76) smaller and bearing five or six fewer tubules; stigmatic chamber shallower, with external part of the respiratory organ twice as deep in the narrowest part.

The profile (Pl. XI, fig. 139) of the last segment with the entire stigmatic area somewhat raised and the intermediate tubercles projecting noticeably near the middle and curving upward, though not so strongly as in *Rhagoletis pomonella* (Walsh); in posterior view (Pl. XI, fig. 138) only one pair of intermediate tubercles seen and the ventrals represented by a single pair.

Interspiracular processes (Pl. XV, fig. 178) about one-third the length of the slits, large, many-branched, but with the tips rounded instead of sharp; fingers with as many as four branches and the larva generally showing more branches than that of *Rhagoletis suavis* (Loew), seventeen to twenty-one usually; the distal wall of the stigmatic chamber almost round but flattened on the inner side, like *Rhagoletis suavis* (Loew), of even texture throughout, with the exception of a scarcely perceptible occasional round mesh in the reticulum.

Recognition characters.—The spinules are confined to the fusiform areas on the ventral half of the body, except for a narrow band on the anterior margin of the prothorax.

Rhagoletis cingulata (Loew)

1862. *Trypeta cingulata* Loew, Monogr. Dipt. No. Amer. 1, p. 76.

The "Common cherry fruit-fly" lives in cultivated cherries, but has also been reared from berries of the fringe tree and from wild tea-olive. It is a pest which was recorded very early in this country, having been mentioned by Harris in 1835. The range as now known, includes the entire middle and eastern region of the United States and Canada, and also embraces the cherry region in the northwestern part of this country. The life-history is very similar to that of other cherry flies, the eggs being laid under the surface of the skin as the fruit begins to turn red, and the puparia overwintering in the ground. The young larvae travel directly toward the seed and live near the center of the fruit until mature. Many wormy cherries have the ap-

pearance of sound fruit at picking time and consequently are shipped around the country in marketing.

Specimens were all from the vicinity of Ithaca, New York, some belonging to the exact lots identified by Illingworth (1912) in his work with fruit-flies.

The maggots (Pl. III, fig. 22; Pl. VI, fig. 67; Pl. X, figs. 122–123; Pl. XIV, fig. 169) closely resemble those of the other American Cherry flies, *Rhagoletis indifferens* Curran and R. *fausta* (Osten Sacken), but differ in the structure of the caudal segment. The present species bears bifurcated intermediate tubercles, while the other two have single-tipped tubercles in that area.

Rhagoletis fausta (Osten Sacken)

1877. *Trypeta* (*Acidia*) *fausta* Osten Sacken, Bull. U. S. Geol. Surv., III, p. 346.

The "Northern cherry fruit-fly" has similar habits to the Common cherry fruit-fly. Its range is likewise very similar except, as its name indicates, it is centered in the more northerly parts of the cherry district. The maggot appears to be associated with the Brown Rot of Cherries, and usually when one is looking for larvae of *Rhagoletis fausta* (Osten Sacken) he should open the cherries affected with that disease.

The specimens studied are from Illingworth's material reared by him in the vacinity and placed in the collection of Cornell University, Ithaca, New York.

The larva (Pl. III, fig. 23; Pl. VI, fig. 68; Pl. X, figs. 125–126; Pl. XIV, fig. 170) of the species is not readily distinguished from that of *Rhagoletis indifferens* Curran but in the adult stage there is no close resemblance in the wing pattern. Usually the species may be identified by the food plant, since it lives in the cultivated cherries and *Rhagoletis indifferens* Curran only frequents wild species.

Rhagoletis indifferens Curran

1932. *Rhagoletis indifferens* Curran, Amer. Mus. Nov. no. 526, p. 8.

This species was described by Curran (1932) from specimens collected in Oregon on wild cherry (*Prunus marginata* Douglas). Curran's chief reason for giving it a specific rank was the fact that it could not be induced to oviposit and develop in the fruits of the cultivated

cherries and that when living near commercial orchards, it never went over into them. On the other hand, *Rhagoletis cingulata* (Loew) would not live in the wild cherries. Benjamin (1934) believed this to be synonymous with *R. cingulata* (Loew) but certain larval differences seem in accord with Curran's identification (Pl. III, fig. 24; Pl. VII, fig. 69). The caudal end (Pl. X, fig. 127) is quite unlike that of *R. cingulata* (Loew) in general appearance, since the intermediate tubercles are bifid in that species and single in the present form. Also the reticulum of the posterior spiracular chamber (Pl. XIV, fig. 171) seems very different, no hexagonal or circular meshes appearing in *R. cingulata* (Loew) as is the case here.

The numerous specimens are all from Corvallis, Oregon, collected by S. C. Jones on wild cherry in August 1931.

Rhagoletis juglandis Cresson

1929. *Rhagoletis juglandis* Cresson, Ent. News, xxx, p. 65.

The larvae of this species are confined to plants of a single genus, *Juglans*. They are found in Arizona, Texas, Kansas, California and Mexico and feed upon the outer husk of the nuts of *Juglans regia* L., *J. rupestris* Engelm. and *J. Hindsii* Sarg. This is the most active of the walnut flies and the adults feed on droplets of moisture, dew and exudations of plant sap found on the fruits. The flies live from seven to fourteen days before laying eggs, which are deposited under the skin in batches of about fifteen in a group. The larvae feed in the green husks, tunneling and breaking down the tissue. The tunnels turn black soon after made, so that the infestation of the fruit may be detected by the external stains on the husks. Because of this staining, the shells of the nuts are permanently discolored and even the meat lying beneath, shows similar discoloration. The nuts are thereby ruined for commercial purposes. The maggots pupate in the ground.

Described from numerous specimens collected in Carr Canon, Arizona, Sept. 15, 1929, from Persian walnut (*Juglans regia* L.) by Boyce.

Larvae of usual shape and color; 8 mm. in length and 1.5 to 2 mm. in diameter; usual fusiform areas evident.

Spinules small, short and thick, scarcely curved, set closely together, either in long almost straight lines, or in short, strongly curved ones; confined to nine fusiform areas, the two anterior areas very small with only four or five

short rows of spinules and scarcely extending up the sides at all; other areas wider, eight to ten lines in width, running a third or more up the sides; spinulose bands not nearly so wide as the bare areas between.

Anterior sense organs present, two-segmented; basal one twice as great in diameter as distal and also twice its height in diameter, outer end of basal segment sunken and the second a globular segment, rising out of it; posterior sensory organ not quite as wide as anterior, wider than its height; four or five sensoria set on a flat distal top; stomal sense organs and guards not seen; stomal ridges small, about seven on each side.

Cephalo-pharyngeal skeleton (Pl. III, fig. 25) similar to that of other members of the genus, but somewhat longer and narrower in comparison to most; hypostome shallower and more angular, with short parastomals and straight rod-shaped subhypostome, when seen in side view; depth of skeleton at dorsal arch little more than twice as much as the height of hypostome.

Anterior respiratory organ (Pl. VII, fig. 70) fan-shaped, with regular gently curved outline, twice as wide as deep, even including chamber; eleven rather large, heavy tubules, not twice as long as the diameter, not at all crowded and each with a tube-like clear area extending downward from center of distal end; reticulum with many small, angular meshes, eleven to twelve across the base of the stigmatic chamber and many more than that distad.

The posterior view (Pl. X, fig. 128) of the caudal segment very smooth and unwrinkled as compared to the other members of *Rhagoletis;* only one depression prominent, that outlining the stigmatic area; four pairs of tubercles including dorsals set near upper edge of stigmatic area and somewhat farther apart than the spiracles, laterals placed opposite the spiracles, one pair of intermediates, placed exactly in a line below the dorsals and a pair of ventrals lying below, and in a line with the spiracles; stigmatic plates somewhat raised, with the outer edges elevated; spiracles fully twice the length of a slit apart and middle slit on one side almost in a straight line with middle one on other side; stigmatic chamber (Pl. XIV, fig. 172) rather large, with wide band of radiations outlining top; reticulum with small, hexagonal, crowded meshes, eight or nine across the small diameter; slits four times as long as wide, with heavy walls and eleven to thirteen mostly blunt teeth, and four to six crossbars, which occasionally interlock; interspiracular processes large and feathery, nine to seventeen trunks with fourteen to thirty-two branches; fingers about half the length of one slit.

Recognition characters.—(1) The anterior sensory organ is as great in diameter as the posterior, the second segment globular. (2) About seven stomal ridges are present. (3) The anterior respiratory organs have rather large uncrowded tubules. (4) The caudal end is very smooth with only one conspicuous depression which outlines the stigmatic area, and with four pairs of tubercles.

Rhagoletis juniperinus Marcovitch

1915. *Rhagoletis juniperinus* Marcovitch, Ann. Ent. Soc. Amer., VIII, p. 171.

The "Juniper maggot" was first observed and described by Marcovitch in 1915 having been reared from berries of *Juniperus virginiana* L. In recent years, the author has collected many maggots from the same host and in the same locality where the originals were taken. The adults lay their eggs in August when the fruits are about half grown, but apparently the maggots develop slowly since full-grown larvae were collected very late in the season, but while the fruits were still on the tree. In October, infested fruit has an apparently undamaged exterior, but when picked up, has so little substance and weight that infested fruits are immediately detected. They are mere shells, being powdery and dry within. After the berries fall to the ground, the larvae enter the soil and pupate there.

The numerous specimens studied were collected in October, 1933 and on October 17, 1934 at Twin Gorges, Ithaca, New York. The usual creamy white of the larvae is often somewhat discolored. They average of smaller size than *R. pomonella* (Walsh), measuring 6 mm. in length by 1 mm. in diameter.

Spinules very indistinct, minute, disappearing entirely in many areas, consequently of little use in identification.

Anterior and posterior sensory organs present and very similar to those of the apple maggot; stomal sense organs also present; guards present, the most prominent seen in the genus; the six to eight small stomal ridges noticeable.

Cephalo-pharyngeal skeleton (Pl. III, fig. 26) of average size, less heavily colored and sclerotized than in *R. pomonella* (Walsh), but quite noticeably long and slender in comparison with that species; mouth hooks decidedly longer than deep; hypostome elongate, rectangular, two and one-half to three times as long as wide, and with the bridge jutting down sharply and conspicuously; anterior margin of dorsal wings very deeply concave, and with the point of the dorsal arch extending out over the hypostome; length of mouth hook plus hypostome about half the length of the dorsal wing; radiations more or less prominent in the pharyngeal skeleton as in most species of the genus.

Anterior respiratory organ (Pl. VII, fig. 71) fan-shaped, gradually flaring from distal end of the stigmatic chamber and practically flat across the outer edge; stigmatic chamber occupying more than half the depth of the entire organ and the reticulum with rather small, irregularly shaped meshes; the twelve uncrowded tubules fully twice as long as wide.

In profile (Pl. X, fig. 130) the last segment much like *R. pomonella* (Walsh), with the intermediate area projecting and its tubercles curved upward; in the posterior aspect (Pl. X, fig. 129) also resembling that species, but differing in the position of the dorsal tubercles, which in the present species, are much closer to each other and set nearer the stigmatic area, and also in having two pairs of supernumerary tubercles near the laterals; the circular spiracular plates rather small, set above the middle line and lying about three times the length of one slit apart ventrally, but spreading dorsally.

Distal wall of the stigmatic chamber (Pl. XIV, fig. 173) small and kidney-shaped, a very narrow marginal clear area around the chamber, with the usual radiations set inside the clear border; reticulum with small round meshes, nine or ten across the narrowest diameter; spindles showing in some preparations; spiracular slits remarkably smooth in outline, being rounded on each end, straight-sided and one-third as wide as long; slit walls of average width at the surface, possessing about twelve weak teeth projecting into the opening; no crossbars at surface of slit but a few visible at a greater depth, where, interlocking crossbars may also be seen, giving an irregular framework; interspiracular processes unique for the genus, each made up of only two or three fine hair-like fingers, scarcely half the length of the slit.

Recognition characters.—(1) The spinules are minute or obsolescent in many regions. (2) The anterior respiratory organ has an evenly flat outer edge, with twelve tubules. The stigmatic chamber shows a reticulum. (3) Guards are larger than in any other species of the genus examined. (4) The interspiracular processes are made up of from two to four unbranched fingers.

Rhagoletis mendax Curran

1932. *Rhagoletis mendax* Curran, Amer. Mus. Nov., no. 526, p. 7.

The "Blueberry maggot" so closely resembles the Apple maggot that no attempt will be made to distinguish the two, although in general the present species is smaller than *R. pomonella* (Walsh). The adult was described from material reared in Nova Scotia and New Jersey, from various species of *Vaccinium*. Its chief claim to specific distinction lies in the fact that it cannot live in the apple, nor can the apple maggot live in blueberry. (Pl. III, fig. 27; Pl. VII, fig. 72; Pl. X, figs. 131-132; Pl. XIV, fig. 174)

The author studied a large number of specimens collected by C. L. McAllister at Cherryfield, Maine.

Rhagoletis pomonella (Walsh)

1868. *Trypeta pomonella* Walsh, Ann. Rept. Nox. Ins. Ill., 1, p. 29.

This is the "Apple maggot" or "Railroad worm", a species native to North America and a serious pest to the apple crop. It is commonly found in *Crataegus* and many other wild fruits in this country. Among the cultivated fruits, plums, pears and cherries may be infested as well as the apple. The maggots tunnel in long winding lanes through the pulp of the fruit, many larvae being found in one apple, although each individual remains solitary in its tunnel. Later the tunnels ruin the entire fruit and since this is usually followed by rot, the apple drops from the tree. The larvae pupate in the ground, one or two inches below the surface. The species is found throughout the apple districts of eastern North America.

Described from a great many specimens supplied by P. J. Chapman of Geneva, New York, and from apples collected at Ithaca, New York by the author.

Maggots are from 8 to 11 mm. long and of the usual shape; body smooth except where wrinkles and folds occur in fusiform areas.

Spinules prominent, strongly curved and hooked at tips; individual lines much curved and short; abundant on fusiform areas and extending beyond, completely encircling the body; no spinules on first thoracic segment; beginning with the intersection of the prothorax and the mesothorax, all subsequent intersegmental areas bear spinules; first two bands narrow, only six to seven rows in width; the other bands wider, even twelve to fifteen rows in some; areas between spinulose bands narrower than the bands; no spinules on caudal aspect of the larva.

All three pairs of sensory organs present, anterior ones two-segmented, the posterior single segmented, with four sensoria; two or three chitinous teeth or guards on lateral lips of mouth; stomal ridges prominent, five to seven in number.

Cephalo-pharyngeal skeleton (Pl. III, fig. 28) moderately large; mouth hooks sturdy, only slightly longer than deep; hypostomal sclerite scarcely as long as the mouth hook; dorsal wings three times as long as the mouth hook, somewhat longer than the posterior pharyngeal plates and considerably deeper; on the dorsal wing, a fan-shaped area is more heavily colored, with triangular indentations in the general outline; on pharyngeal plate a somewhat similar darkened area but this more deeply notched; the hypostomal sclerite triangular in lateral view; parastomals and subhypostomals present; also the epistomal sclerite with lateral prolongations connecting with the inside of the hypostome, clearly visible from above.

The anterior respiratory organ (Pl. VII, fig. 73) prominent, flared; tubules somewhat bulbous at the tip, crowded, even assuming three rows, the central row being much longer than the other two, but when flattened in prepared slides, the entire number appearing crowded into a single irregular fluted row; external area of respiratory organ at narrowest part about equal to depth of stigmatic chamber; number of tubules not constant, even on the opposite sides of a single individual, but ranging from nineteen to twenty-two; atrial reticulum with small, rectangular meshes, fifteen across one side of chamber.

In side view (Pl. X, fig. 134) the posterior segment strongly tuberculate with the bifurcated intermediates curved sharply dorsad; stigmatic area somewhat raised; posterior spiracles (Pl. X, fig. 133) slightly above middle; lower ends of spiracular plates approximating each other and lying at an angle of about forty-five degrees, one-fourth the length of the spiracle apart, but dorsally the entire width of the plate apart; tubercles very prominent; dorsals, laterals and ventrals as usual; one pair of outer intermediates near the laterals; inner intermediates bifurcated; indistinct scar; slits four times as long as wide; walls of average width, many teeth and crossbars; two ventral spiracular slits of one side nearly parallel; the dorsal slits of opposite sides nearly in a straight line with each other; spindles conspicuous (Pl. XIV, fig. 175); distal wall of the stigmatic chamber showing reticulum with large hexagonal meshes, about eight across the widest part; interspiracular processes large and feathery, longest trunks fully half as long as the slits; trunks numbering nine to fifteen with twenty-four to thirty-one needle-like gracefully curved branches.

Recognition characters.—(1) The cephalo-pharyngeal skeleton bears a fan-shaped more heavily sclerotized area on both the dorsal wing and the pharyngeal plate. (2) The tubules on the anterior respiratoy organ are arranged in three parallel rows. (3) The inner pair of intermediate tubercles are bifurcated. (4) Interspiracular processes are feathery with many trunks and branches.

Rhagoletis ribicola Doane.

1898. *Rhagoletis ribicola* Doane, Ent. News, IX, p. 69.

The "Black currant-worm" is restricted in distribution to the Pacific northwest and Idaho. The maggots live in fruits of red currants and gooseberries, infesting both the wild and the cultivated forms. The species was described in 1898, but Cresson (1929, p. 406) places the name in the synonymy of *R. tabellaria* Fitch. Since Cresson also placed *R. juniperinus* Marcovitch in the same synonymy and inasmuch as the preparations of the present author show quite decided differences between *R. ribicola* Doane and *R. juniperinus* Marcovitch, each species shall be discussed under these names instead of accepting

Cresson's disposition under *R. tabellaria* Fitch. Unfortunately, no larval specimens of *R. tabellaria* Fitch were available for the present study, so no conclusions can be made as to which of these other two is synonymous with *R. tabellaria* Fitch.

The thirteen specimens studied are all from Burns, Oregon, having been collected there by S. C. Jones on *Ribes aureum*, June 19, 1934.

Maggots creamy white, smaller than usual, specimens measuring 8 mm. in length by 1.4 mm. in diameter.

The spinules on the body of this species very conspicuous, with globular bases, and suddenly narrowed apically to needle-like points, usually arranged in short, closely set curved lines, six to eight in a line; a wide spinulose band visible on the usual area of the first segment, but only a few lines complete the circle around the venter; near the next three or four intersections between segments, narrow bands, sometimes only a single line wide, along the dorsal side of the body; beginning with the intersegmental line between the thorax and abdomen, all succeeding intersections with wide fusiform spinulose areas on the venter, running up the sides of the body.

The anterior sensory organs similar to those in *R. pomonella* (Walsh) but smaller in size and quite noticeably longer; posterior sensory organ of a single segment, about the same height and width as the anterior and with five sensoria rising from the outer end; stomal sense organs and guards both present; stomal ridges very evident, some twelve or thirteen on each side of the mouth.

Cephalo-pharyngeal skeleton (Pl. III, fig. 29) smaller than in *R. pomonella* (Walsh) but more heavily colored and sclerotized; dorsal wings and pharyngeal plates with no fan-shaped radiations as seen in the above-mentioned species; entirely dark area on the anterior quarter of the pharyngeal plates, narrowing suddenly to a single long ray bordering the dorsal edge of the plates; in the dorsal wings, this heavily sclerotized part, with indentations and long projections; dorsal wing nearly twice as long as the length of the mouth hook and hypostome combined; hypostome elongate and nearly rectangular, with the line of union with the pharyngeal skeleton much more nearly vertical than in the apple maggot.

The anterior respiratory organ (Pl. VII, fig. 74) with a cylindrical basal area not quite as deep as wide, suddenly spreading out into lobe-like lateral pieces, leaving a wide notch in the outer rim of the organ; no meshes, but the entire chamber appearing filled with heavy granular material; sixteen tubules, with the outer third marked with even heavier granular spots; an occasional tubule with a minute apical channel-like opening, indicating the location of the external spiracle.

Caudal aspect (Pl. X, fig. 135) of the last segment very characteristic, the only member of the genus in which it is smooth, tumid and generally rounded, all depressions very shallow and hardly discernible; intermediate tubercles placed on the middle transverse line, but almost touching the ventral edge of the stig-

matic area; two pairs of intermediate tubercles lying close together on each side, and the entire group of four arranged in the middle, just below the posterior spiracles; a pair of dorsal papillae above the stigmatic area, but slightly removed from its dorsal border; spiracles small, the plates set about the length of two slits apart ventrally, but spreading to twice that distance dorsally.

The small spiracular plate (Pl. XIV, fig. 176) nearly circular; distal wall of the stigmatic chamber oval in outline, of average size but with no meshes apparent, only an irregularity of granular structure; slits two-fifths as wide as long; slit walls of usual width, with a few teeth on each side, but all such projections either quite or almost touching in the middle; spindles present; interspiracular processes small, of three to five trunks, with six to twelve branches each; a minute clear, globular structure at the base, from which all fingers of one process arise; trunks sometimes unbranched, sometimes many-branched; interspiracular processes more than half the length of one slit, and the branches narrow and sharp-tipped.

Recognition characters.—(1) The posterior sense organ bears five post-like sensoria. (2) Anterior respiratory organ has no meshes in chamber, but possesses sixteen tubules. (3) The caudal end is smooth, tumid and rounded, with only three pairs of tubercles, one dorsal and two pairs of intermediates, the latter set closely together near the ventral side of the spiracle. (4) Stigmatic chamber lacks meshes and reticulum; slits two-fifths as wide as long, with nearly all the teeth touching. Interspiracular processes are small, but more than half the length of the slit and with only three to five trunks, but with many branches, the trunks radiating from a single clear spot.

Rhagoletis suavis (Loew)

1862. *Trypeta suavis* Loew, Monogr. Dipt. No. Amer., 1, p. 75.

The "Walnut husk maggot" is a common pest of the native black walnut and butternut wherever these occur. It also attacks the Persian or English walnut (*Juglans regia* L.) and the Japanese walnut in cultivation. The eggs are laid in the husks of the nuts when they are nearing maturity. The female punctures the skin and lays clusters of eggs under the surface. She chooses a hole already made in the fruit, however, and several females will oviposit in the same hole. Brooks (1921, pp. 5-6) told of having made punctures with a nail in several nuts. Almost as soon as the juice began to ooze out, a male would arrive and stand guard over the hole, awaiting a female. Such a male would remain beside the hole for several days and copulate with each female

which visited the hole. Although the eggs are always laid in nuts still hanging on the tree, most of the evidence of infestation is seen in those lying on the ground. The young maggots feed on the softer parts of the husk, usually near the nut proper. The hulls are blackened and made slimy within and this causes discoloration of the nuts, rendering them unfit for market. In the late autumn, long after the nuts have fallen, the maggots leave them and enter the ground for pupation. They are active and move about freely, using the anal hooks as an aid to locomotion while searching for a suitable entrance into the ground. The larva and puparium were first described and figured by Babb (1902, p. 242).

Described from a large number of larvae, some from French Creek, West Viriginia, taken by Fred E. Brooks in black walnut, some from F. L. Gambrell, Geneva, New York, and others collected by O. A. Johannsen in butternuts at Ithaca, New York. They are 8 to 10 mm. long by 2 mm. in diameter.

Anterior and posterior sensory organs present, similar to those of *R. pomonella* (Walsh) and of approximately the same size; stomal sense organs and guards also similar to those of the apple maggot, but with the stomal ridges somewhat less prominent, nine to ten in all; spinules and spinulose areas similar to those of *R. pomonella* (Walsh).

Cephalo-pharyngeal skeleton (Pl. III, fig. 30) with quite different proportions than that of *R. pomonella* (Walsh) being longer and narrower; mouth hook long and gradually tapering, only five-sevenths as great in depth as in length; hypostome narrow, less than half its own length, but about as long as the width of the mouth hook, especially narrow at line of union with the pharyngeal skeleton and joined to it obliquely in a long, gradual slant; anterior edge of the dorsal wing, making a very deep curve and extending inward from a sharp projection at the dorsal arch, this corner being placed well forward over the hypostome; the combined length of the mouth hook and the hypostome equalling three-fourths of the wing length; subhypostome weakly colored and sclerotized, very inconspicuous and usually hidden behind the other sclerites; parastomals prominent.

Anterior respiratory organ (Pl. VII, fig. 75) resembling that of *R. pomonella* (Walsh), but appearing to have twenty-five tubules in a single row, and those not badly crowded out of line; outline of the distal edge presenting a flatter curve.

The most conspicuous difference between this and the apple maggot presented by the profile (Pl. XI, fig. 137) of the caudal segment, in *R. pomonella* (Walsh) the tubercle bearing the intermediate papillae actually curving dorsally toward the spiracles and in *R. suavis* (Loew) this region pointing downward; in the

posterior view (Pl. XI, fig. 136) the intermediate tubercles on one side running together into a flat projection instead of a pair of papillae; a similar transverse, widened bifid tubercle being found on the ventral area, and lying directly below the intermediates.

In the posterior spiracle (Pl. XIV, fig. 177) the distal wall of the stigmatic chamber round and with no indication of a reticulum, the region being entirely granular in appearance; spiracular slits with heavy walls and with fewer but stronger crossbars and teeth; interspiracular processes in general, composed of fewer fingers, but like *R. pomonella* (Walsh), branches occurring at any point along the finger.

Recognition characters—(1) Cephalo-pharyngeal skeleton is somewhat longer and narrower than that of the apple maggot, the mouth hook large, the hypostome small, but together their length equals three-fourths that of the dorsal wing. The dorsal wing rises high above the hypostome and makes a deep curve inward. (2) The anterior respiratory organ has a fan-shaped outline which is somewhat flattened along the distal edge with twenty-five tubules in a single row. (3) In profile, caudal end of *R. suavis* (Loew) bears intermediate tubercles which are directed downward. In caudal aspect, these two intermediate tubercles seem to lie so close as to form a continuous transverse ridge instead of a bifid tubercle. The ventrals bear similar coalesced pairs of papillae. (4) The distal wall of the posterior stigmatic chamber shows evenly granular texture throughout. Spiracular slits have fewer but stronger teeth and crossbars than are found in *R. pomonella* (Walsh). The fingers of the interspiracular processes are not so numerous.

Rhagoletis symphoricarpi Curran

1924. *Rhagoletis symphoricarpi* Curran, Can. Entom., LVI, p. 63.

The "Snowberry maggot" has been reared only from the fruits of *Symphoricarpos racemosus* Michx., unless Benjamin (1934, pp. 16-17) was correct in placing it in the synonymy under *Rhagoletis zephyria* Snow. In that case the hosts will include the fruit of the sparkleberry (*Batodendron arboreum* Marsh) from which he reared it in Florida.

Specimens studied by the author were collected by S. C. Jones at Corvallis, Oregon. Before Benjamin's paper was published the distribution was limited to British Columbia and Oregon.

The larvae are very similar to the young of *Rhagoletis pomonella* (Walsh). Benjamin states (1934, p. 17) that the differences are

insignificant since these are confined to a smaller size and to the presence of one or two fewer tubules on the anterior respiratory organ (Pl. VII, fig. 77).

The author's material, however, shows a noticeable difference in the proportions of the various parts of the cephalo-pharyngeal skeleton. The mouth hook (Pl. IV, fig. 32) and the hypostome are both smaller, when compared to the dorsal wing than is the case in *R. pomonella* (Walsh). The length of the dorsal wing is twice as great as the length of the mouth hook and the hypostome combined. In the Snowberry maggot, the anterior margin of the wing is curved to a sharp point, actually extending above the hypostome.

In the posterior view (Pl. IX, fig. 140) of the last segment, there are several more tubercles and papillae than in *Rhagoletis pomonella* (Walsh). A double pair lies laterad and slightly below the ventral edge of the posterior spiracles. A third pair lies in the lower, lateral region, scarcely below the intermediates, but laterad to them.

The illustration (Pl. XV, fig. 179) shows no crossbars in the spiracular slits, but this condition does not always hold, although there are often only one or very few.

Straussia longipennis (Wiedemann)

1830. *Trypeta longipennis* Wiedemann, Aussereur. Zweifl. Ins., II, p. 483.

The "Sunflower maggot" has been found abundantly in the canes of the cultivated sunflower and in New York state has been taken from Jerusalem artichoke, which had been introduced from Europe. It has been collected in the Atlantic states and west to Colorado and Montana, but its range does not extend into the far south.

The specimens studied were from various sources. A large number were collected by Pshimetcki at Babylon, New York, Aug. 10, 1932 and lent by Blanton for examination. Others were collected by O. A. Johannsen from pith of sunflower stems near Ithaca, New York, and still others were preserved by M. V. Slingerland in 1900, from Jerusalem artichoke.

Larvae large, measuring 9 mm. in length and 2.5 mm. in diameter; neither as pointed anteriorly, nor so truncated caudally as in most trypetid larvae.

Spinules present, although rather small and inconspicuous; short and stout, sharp-pointed but not tapering; band on first segment made up of eight rows of short lines of closely ranked spinules, more prominent on dorsum and ex-

tending down two-thirds of the way toward the venter; no spinules between first and second thoracic segments; a few on the next two intersections in a wedge-shaped area on the dorsum; all subsequent intersegmental areas with wedge-shaped regions both on the venter and the dorsum, running over in each instance along the sides, but not quite touching so as to encircle the body; spinulose areas not very wide, the rows scattered and with only a few spinules in each; posteriorly, the spinules becoming smaller and smaller until scarcely distinguishable near the caudal end.

Anterior sensory organs peculiarly shaped, composed of three segments, the cylindrical basal one much larger, twice as long as wide, with a second segment scarcely half its diameter, set on the first, and a third sub-globular piece set on this; the posterior organs almost as long as the anterior, but consisting of a single segment each, sides not bulged, but wavy in outline, enclosing distal rim very heavily sclerotized with three or four long post-like sensoria projecting noticeably beyond the rim; no stomal sense organs or guards; seven or eight small and inconspicuous stomal ridges.

Cephalo-pharyngeal skeleton (Pl. IV, fig. 33) large, only the mouth hook and hypostome heavily colored; mouth hook rather slender and sharp at tip and directed sharply downward, a tooth about midway along the ventral border; the mouth hook as long as wide; hypostome small, triangular in general shape; heavy and prominent subhypostomal sclerites; parastomals present; length of hypostome about three-fourths that of the mouth hook; anterior edge of dorsal wings suddenly rising only a short distance above the hypostome, but from the dorsal arch caudad, the wings curve upward in a wide arch; dorsal wings very large and long, with a few narrow projections of heavier chitin.

Anterior respiratory organ (Pl. VII, fig. 79) very large and unique in this species; the external part broad and flat across the tip, with four or five partial rows of tubules, making from twenty-five to fifty-three in all; each tubule twice as long as wide and flattened on top; stigmatic chamber wide and shallow with many tiny irregular meshes, about twelve across the neck; narrowest part of the external spiracle about equal to the depth of the stigmatic chamber; distally, the respiratory organ measuring twice as much as the width of the stigmatic chamber.

Caudal end (Pl. XI, figs. 141, 142) with the stigmatic area sub-circular, a tumid roll outside the spiracles and two increasingly larger rolls outside this one, the third being crescent-shaped and not extending across the dorsum in posterior view; spiracular plates large and nearly parallel, with the middle slits of the two sides in a straight line with each other; area between spiracular plates depressed and the ventral borders lying about on the middle transverse line; the second circular roll bearing most of the tubercles and papillae; two pairs of dorsals, the inner ones being set farther apart than the outer edges of the stigmatic plates, the second pair lying quite close and laterad to the first pair; intermediate area with one pair of prominent tubercles lying just below the ventral margin of the stigmatic area and barely beyond the lateral edge of the

plates; a second pair of intermediate papillae situated close to the first but placed higher and laterad to it; the third or crescent-shaped roll bearing the lateral papillae on its extreme dorsal tip, as well as the ventral tubercles directly below the first intermediates; these four conspicuous tubercles all having distally widened papillae.

The distal wall of the posterior stigmatic chamber (Pl. XV, fig. 180) narrowly kidney-shaped in outline, with an extremely narrow area of radiating lines on its circumference; reticulum with elongate hexagonal meshes, set together with their long axes lying across the chamber, six or seven filling the space across the narrowest diameter; scar very conspicuous; spiracular slits very long and narrow, only one-fourth as wide as long, slit wall rather weak, with its outline quite regular but the inner edge bearing projections at short intervals, giving it a scalloped appearance; a large number of weak teeth on each side, but no crossbars; spindles very prominent; interspiracular processes large, the needle-like, mostly unbranched fingers gracefully curved, basal piece of each scroll-like in appearance with the fingers apparently attached inside and behind the base, branching in the distal half of the fingers, ten to nineteen trunks with ten to twenty-three branches.

Recognition characters.—(1) The structure of the anterior respiratory organ is so peculiar that no other difference need be mentioned for the identification of this species.

Tephritis finalis (Loew)

1862. *Trypeta finalis* Loew, Berl. Ent. Zeit., VI, p. 222.

The species has been reared from seed of *Actinomeris* sp. in Texas and from flower heads of *Encelia californica* Nutt. in California. Little was known of its life history until the summer of 1936. It was then found by Bissell to be doing considerable damage to the flowers of dahila grown in experimental gardens at Georgia Experiment Station. The female lays eggs in the developing dahlia buds, inserting her ovipositor between the bracts. The growing maggots feed upon the bases of the flowers causing them to rot and dry up. From one to twenty larvae are found in a single flower head. The puparia are formed there, before the flower head dries up.

Many specimens were studied, some taken by S. C. Jones at Colorado Lake, Oregon, on June 23, 1933 and others supplied by Bissell from Georgia.

Larvae 4.5 mm. in length by 1.5 mm. in diameter; somewhat heavier than usual; not so sharply tapering anteriorly.

Spinules numerous, conspicuous, round and heavy basally, with suddenly tapering sharp tips; an encircling spinulose band around the anterior part of

the first thoracic segment, also around all intersegmental regions; anteriorly, the spinules placed in rather long, barely curving lines, but scattered posteriorly; caudal end with many spinules, only the stigmatic area being entirely bare, a rather definite band surrounding the limits of the stigmatic area and extending upward to the dorsal margin, in the intermediate and ventral areas, the band narrower.

Anterior sensory organs present, two-segmented, the basal one wide, straight-sided, only half as high as wide, with the second segment one third smaller in diameter and tapering, a weak collar slightly larger than the distal circumference completing the organ; posterior sensory organs also present, one and one-half times as high as the anterior, nearly straight-sided and twice as long as wide, heavy-walled, with five to seven sensoria; no stomal sense organs or guards seen; no stomal ridges.

The cephalo-pharyngeal skeleton (Pl. IV, fig. 34) small but heavily sclerotized and colored, rather angular in appearance; mouth hook deeper than long, with one or two tooth-like projections along the ventral margin; hypostome rectangular, nearly twice as long as wide, fully two-thirds as deep as the mouth hook; parastomals absent, but subhypostomal sclerites heavy and prominent; depth of pharyngeal skeleton at dorsal arch only one-third greater than the touching hypostome; dorsal wings rising slightly and in a straight line, longer than the pharyngeal plates; oval holes near the outer ends of the pharyngeal plates.

External part of anterior respiratory organ (Pl. VII, fig. 78) palmate, with five tubules, sometimes bulged near the tips, with no indications of spiracular openings, and no distal region of heavy granulation; stigmatic chamber not quite as high as wide, with reticulum composed of fairly large diamond-shaped cells.

The caudal end (Pl. XI, fig. 143) very smooth with no tubercles nor papillae, but with various depressions, around which the spinules are clustered; spiracular plates set on the middle transverse line, about two and one-half times the length of a slit apart ventrally and spreading dorsally.

The spiracular plates (Pl. XV, fig. 181) of the posterior stigmata rather long and flattened on the inner side; the distal wall of stigmatic chamber very narrow, kidney-shaped, reticulum with large circular meshes, only four across the narrow side; slits more or less rectangular, two and one-half times as long as wide, walls of usual width, with eight to ten teeth along one side, no crossbars visible, even deeper down in the opening.

Interspiracular processes of rather wide fingers, averaging more than half the length of one slit; fingers lanceolate, with several wider ones showing a deep notch at the tip instead of the usual branches; notches never extending more than one-fifth the distance from the tip; five to ten trunks with two or three of these notched in each process; a minute crescent-shaped basal piece somewhat curled under, scroll-like at the ends.

Recognition characters.—(1) External anterior respiratory organs are palmate, with five large tubules, without distal clear areas or heavy granulations. (2) No tubercles are seen on caudal segment, but numerous spinules here. (3) Posterior spiracles are placed on the middle transverse line. (4) Fingers of interspiracular processes are widely lanceolate, several notched in the outer fifth.

Toxotrypana curvicauda Gerstaecker

1860. *Toxotrypana curvicauda* Gerstaecker, Stett. Ent. Zeit., XXI, p. 194.

The "Papaya fruit-fly" feeds only on the papaya, preferring the wild to the cultivated forms. It exists, doubtless, wherever the papaya is grown in the New World, being found in Florida, Texas, South Carolina, The West Indies, Brazil, Yucatan and Bahamas.

The female possesses a very long ovipositor and after assuming a position similar to that used by Ichneumon flies in oviposition, pushes it through the outer shell of a papaya fruit and oviposits in the seed cavity. These eggs are of a very peculiar shape, being of the usual form but with a long drawn-out almost thread-like prolongation at one end. The eggs are laid in a cluster and cemeted together by some substance which is deposited by the adult, at the time of deposition. There are six to twenty eggs in a cluster. Several of these clusters may be inserted, so that as many as forty larvae are often found in a single fruit. The females are most active in the evening but will usually not oviposit in a fruit which already contains eggs or maggots. They often sting fruit many times without ovipositing. As soon as the skin of the green fruit is punctured, a white milky juice wells up, coagulating in the air and becoming sticky. Often females are caught in this juice and never escape alive. Normally the juice runs down the sides of the fruit and gradually darkens and stains it. This is usually a test for wormy fruit. After hatching, the maggots feed on the coatings of the seeds, often detaching them in the process. This habit leads to another test for wormy fruit, which is to shake the ripening papayas and if the seeds rattle around inside, maggots are surely present. About half the life of the maggot is passed in this seed cavity but later it eats into the flesh and when mature, lives close to the skin. Maggots do not thrive in green fruit and it was formerly thought that the milky juice was poisonous to them. This belief was later proved to be false, but certainly the larvae never enter the pulp until it begins to

turn yellow. This coloring happens prematurely in infested fruits. The full-grown maggot eats a hole through the skin and drops to the ground. Very often, the larvae will all leave the fruit by a single exit hole, made by the first one. They drop to the ground and start burying themselves at once. Occasionally maggots may pupate in the fruit, but that is unusual.

Described from numerous specimens collected by F. S. Blanton at Cocoa Beach, Florida, Nov. 4, 1932.

This is a very large species, and the larva may measure as much as 14 mm. in length and 4 mm. in diameter. Maggots are of the usual shape with conspicuous fusiform areas on all intersections between the thoracic segments and the abdominal ones.

Spinules confined to the fusiform areas, except on the thoracic segments, where a very few, even a single line, of indistinct spinules may encircle the body; spinules rather small and very sharply pointed; abdominal region bearing spinules directed at various angles, but scarcely curved; spinulose areas composed of twelve to fifteen rows of almost continuous wavy lines.

Anterior sensory organs present, two-segmented, the basal one about as high as wide but distally somewhat drawn in to about half the former diameter, a second globular, distally tapered segment connected with this neck, and of the same small diameter; posterior sensory organ about as high as the first segment of the anterior, but much wider, with heavily sclerotized casing, from the depressed top of which seven or eight sensoria arise; neither stomal sense organs nor guards visible; about thirteen prominent stomal ridges.

Cephalo-pharyngeal skeleton (Pl. IV, fig. 35) large but only the anterior third heavily sclerotized; mouth hook gently tapered distally to a slender tip, depth a little less than its length; hypostome only two-thirds the length of the mouth hook, rectangular in outline with the crossbar slightly projecting below the floor; subhypostomal sclerite present; dorsal wings suddenly towering dorsad at the junction with the hypostome, until the height at dorsal arch is fully twice as much as that of the hypostome, dorsal wings somewhat longer than pharyngeal plates and only a small region on the inner side heavily colored; pharyngeal plates with prominent projections on inner or dorsal margins.

External part of the anterior respiratory organ (Pl. VII, fig. 80) large, fan-shaped but constricted in the middle of its outer margin; stigmatic chamber not indicated by the usual reticulum but whole organ of a uniform granular structure; about twenty-two small, straight-sided tubules, with flattened tips, showing a narrow clear space across entire distal end and with heavily granular appearance there, tubules somewhat crowded and pushed out of shape.

The caudal end (Pl. XI, fig. 144) rather smooth with only a few depressions and tubercles; stigmatic area situated in the dorsal third; the posterior spiracles appearing very dark, almost black; spiracular plates quite evident, ventrally set

only about the length of two slits apart but slightly spreading dorsally; a pair of intermediate papillae set almost touching the ventral boundary of the stigmatic area and almost exactly under the spiracular plates; lower central portion of caudal segment raised, and with an irregular diagonal line on each side marking a rather sudden lowering of the ventro-lateral corners; a pair of ventral papillae situated just inside these diagonal lines, well above the anal lobes and a little farther apart than the posterior stigmatic plates.

The stigmatic plate (Pl. XV, fig. 182) oval, with a rather prominent scar; outline of the distal wall of the posterior stigmatic chamber long, narrow, kidney-shaped; the marginal area of radiations very wide at the ends but of the usual thickness along the sides; reticulum indistinct with lines running in elongate diamond shapes, seven or eight across narrowest diameter; spindles prominent; slits long and narrow, one-fifth as wide as long; slit walls heavier than usual, with many interlooking crossbars of the same thickness as the wall itself, no teeth; interspiracular processes in small tufts, fingers needle-like, three to five trunks with eight to eleven branches, branching rather irregular usually in outer quarter, often three branches to one trunk; fingers one-third the length of the slit.

Recognition characters.—(1) The maggots of this species are very large. (2) The anterior respiratory organ is composed of twenty-two tubules and is fan-shaped with a noticeable constriction in the middle of the distal outline. (3) The caudal end bears only a pair of intermediate and a pair of ventral papillae, and only the stigmatic area is outlined by a depression. (4) Interspiracular processes are small often with three branches to one finger.

Trupanea abstersa (Loew)

1862. *Trypeta abstersa* Loew, Berl. Ent. Zeit., VI, p. 221.

This species has been reared from flower heads of *Trilisa paniculata* (Walt.) Cass. While it is recorded from New England, Florida, Texas and California in this country, it has also been taken in Cuba, Mexico and South America.

Described from four specimens collected by D. T. Nicholson near Winter Park, Florida on November 10, 1933, which were lent by the United States National Museum.

Maggots small, measuring about 2.5 mm. in length and 1.5 mm. in diameter, but of larger proportional diameter than are most fruit-flies; otherwise, quite in accord with other maggots in general shape and appearance.

Spinules somewhat larger than in *Trupanea actinobola* Lw., round basally, conical and sharp-pointed at tip; arranged uniformly throughout the spinulose areas; these areas in the form of irregular bands, wider on the venter and

there almost touching neighboring bands; dorsal spinulose bands narrow, not filling one-fifth of the width of the segment; spinules noticeable in a wide circle around the outer borders of the posterior view of the caudal segment.

Anterior sensory organs present, of a single segment each, cylindrical, smaller distally and about twice as long as the diameter, with a wide collar at tip; posterior sensory organ also present, much larger than the anterior, both in height and width, barrel-shaped, with a few post-like sensoria extending out of the top; no stomal sense organs, guards or stomal ridges.

Cephalo-pharyngeal skeleton (Pl. IV, fig. 36) small, but heavily sclerotized and colored; mouth hook small but longer than deep, with a very small, slightly jutting dorso-caudal corner; a distinct rounded tooth on ventral margin, close to the anterior extremity; hypostome elongate and rectangular, one and one-half times the length of the mouth hook and more than twice as long as wide; subhypostome narrow and inconspicuous; hypostome noticeably more than half as deep as the pharyngeal skeleton at line of union; dorsal arch not projecting forward above the hypostome; dorsal wing no more than twice the length of the mouth hook and hypostome together, but extending backward beyond the pharyngeal plates; an oval hole in each pharyngeal plate beyond the middle, the two extensions surrounding this hole being strongly sclerotized.

The anterior respiratory organ (Pl. VII, fig. 81) narrowly fan-shaped, with four or five large tubules along the outer margin; structure, general appearance and shape of this organ very similar to that of *Trupanea subpura* Johnson.

The caudal segment (Pl. XI, fig. 145) a little wider than deep; transverse mid-line running through the middle of the stigmatic area; no external indications of spiracular plates in alcoholic material, but the stigmata lying almost parallel to those on the opposite side, scarcely twice the length of one slit apart; a pair of dorsal papillae situated far apart on the outer corners of that area; lateral tubercles more ventrally placed than usual, lying quite a distance below the posterior spiracles; a second pair of papillae lying in this same lateral rim, near the ventral edge; the ventral region shaped like a crescent, with arms extending up to the mid-line, each arm bearing a papilla at its extremity; a wide spinulose band encircling the stigmatic area.

In higher magnification, the posterior spiracles (Pl. XV, fig. 183) appearing quite different from those of other species of this genus; no spiracular plate present; distal outline of the posterior stigmatic chamber small, kidney-shaped, with a narrow band of radiations; reticulum with circular, uncrowded meshes, about four stretching across the narrow diameter; slits radiating from center, long and narrow, three times as long as wide, with weak walls, scalloped both on the outer and inner edges; sometimes only a few teeth along each side, with a single crossbar, or perhaps many crossbars and only one or two teeth.

The interspiracular processes of about average size, although the needle-like fingers more than half the length of the spiracular slits; eight to eleven trunks with a few branches near the middle; the whole process very stiff in appearance.

Recognition characters.—(1) Cephalo-pharyngeal skeleton is small, with heavy hypostome and central oval hole in the pharyngeal plate. It possesses a strong tooth on the ventral margin of the mouth hook. (2) The anterior respiratory organ is quite similar to that of *Trupanea subpura* Johnson, except in the number of tubules present. (3) The caudal end bears the posterior stigmata exactly on the transverse mid-line, with no spiracular plates and with the spiracles of one side nearly parallel to those of the other side and separated by twice the length of one slit. The ventral area is crescent-shaped with arms extending up laterad to the middle line and with a papilla on the tip of each arm; a wide spinulose band encircles the stigmatic area. (4) The posterior spiracular slits radiate from the center. These slits are about three times as long as wide. The weak wall is scalloped on both inner and outer margins and crossbars are visible in all slits. (5) The interspiracular processes are quite different from all of the others in the genus, having narrow needle-like fingers which are arranged in tufts of from eight to eleven and with only a very few branches.

Trupanea actinobola (Loew)

1873. *Trypeta actinobola* Loew, Monogr. Dipt., No. Amer., III, p. 326.

The larva of this species lives in the flowers of Compositae, usually one in a single head. Since adults have been reared from flower heads picked from the plant, the puparia are evidently formed there. This species has been taken in Texas, Florida and New York.

Described from several specimens from Babylon, New York, collected by F. S. Blanton in *Erigeron sondbergiana,* July 1, 1931.

The maggots are very small, measuring about 2.5 mm. in length and .75 mm. in diameter.

Spinules very small, like tiny dots uniformly spread over the spinulose areas, which assume the form of bands on the extreme anterior edge of the segments; spinulose bands occupying about one-third of the width of the abdominal segments, but narrower toward the anterior end.

Anterior sense organs present of two segments, basal one wide and short, more than twice as wide as long, with a rather large distal segment set inside, with bulging sides and a collar projecting outside the segment only a slight distance; posterior sensory organs about the same height as the anterior, of a single bulging segment, inside the distal rim, three rather narrow and long sensoria, extending outward considerably beyond the rim of the segment proper; no stomal sense organs, guards or stomal ridges.

The cephalo-pharyngeal skeleton (Pl. IV, fig. 37) small but broad and quite heavy; mouth hook about as deep as long; hypostome about the same depth as mouth hook along its caudal border, but anteriorly only about half as deep, twice as long as mouth hook, the massiveness of this hypostomal sclerite being responsible for the heavy general appearance of the entire skeleton; subhypostome prominent; no parastomals present; at junction with the pharyngeal skeleton, the hypostome distinctly more than two-thirds as deep as the skeleton; a short rounded notch in the anterior margin of the dorsal wing, just above the hypostome, leaving a rounded arch; dorsal wings and pharyngeal plates making a broad angle with each other; length of the dorsal wing less than twice that of the mouth hook and hypostome combined; each pharyngeal plate with a large oval hole in its interior.

The anterior respiratory organ (Pl. VII, fig. 82) triangular in general outline, external part with a row of four rounded tubules; anterior stigmatic chamber about as wide at distal edge as the depth of the chamber; no visible reticulum; tubules about one-half as deep as chamber, with no clear areas at tips, but each uniformly rounded and containing a large granular area in outer third.

In the posterior view, the last segment (Pl. XI, fig. 146) with notable features; no spindles found; spiracles on a very shallow and sunken semi-circular stigmatic area, with no plates apparent in this view; stigmata of opposite sides separated by twice the length of one slit, slightly above the middle and spreading dorsally; no dorsal tubercles or papillae visible, but the dorsal area rather broad and smooth; one pair of laterals in the usual position, just on a line with the dorsal slits; two pairs of ventral papillae on a rather large raised, lobe-like piece, close to the arms; two other pairs of tubercles found, lying one above the other, between the laterals and ventrals.

Spiracular plate (Pl. XV, fig. 184) small, jutting out beyond the stigmatic chamber a very short distance in all directions; the reticulum only a cluster of circular disc-like meshes near the middle of the inside edge, these almost like plates piled on top of each other; the rest of the chamber uniform in structure, with no marginal radiations visible.

The slits wider on the outside and all showing a distinct break in the wall at the widest place; slits short and wide, scarcely twice as long as wide, square-ended; wall of the usual thickness, but with many weak teeth, deeper within the slit, many more teeth placed irregularly all over the inside walls; interspiracular processes unique, made up of only one to four fingers, each somewhat longer than half the length of a slit, sometimes composed of a single finger with three branches very close to the base and appearing like separate trunks, branches wide, spatulate and distally narrowed on both sides into a sharp tip.

Recognition characters.—(1) Cephalo-pharyngeal skeleton is small but massive, hypostome two-thirds as deep as the pharyngeal skeleton at junction of the two; dorsal wing not twice the length of mouth hook

and hypostome together. (2) The anterior respiratory organs have four large, rounded tubules. (3) The spiracular slits are twice as long as wide, with truncated ends. (4) The interspiracular processes bear one to four wide spatulate fingers, which are usually branched.

Trupanea jonesi Curran

1932. *Trypanea jonesi* Curran, Amer. Mus. Nov., no. 556, p. 6.

The "Aster fly" was reared by S. C. Jones from *Aster Douglassi* in Oregon. The species has also been taken in Wyoming.

Described from fourteen specimens collected by Mr. Jones at Corvallis, Oregon, Sept. 19, 1931.

Maggots very small, being about 3 mm. long and 1.5 mm. in diameter; fusiform areas noticeable in alcoholic specimens, but spinules not confined to these areas.

Spinules small, round basally, conical but blunt at tip and scarcely as high as the basal diameter; from above appearing like tiny warts instead of spinules; a very narrow indistinct band of three or four lines on dorsum between first and second thoracic segments and another between second and third; bands extending along the sides, disappearing three-fourths of the way toward the venter; on all other intersegmental areas, wide bands encircling the body, the spinulose areas being about as wide as the naked areas; except on the two thoracic intersections mentioned above, no definite rows of spinules; all others scattered regularly over the spinulose bands.

Anterior sensory organ of three segments, the first about twice as great in diameter as its height, the second about three-fourths as wide as the first and about one-half as deep, and a third bulbous, of even smaller diameter, but slightly higher than wide; posterior sensory organ large and composed of a single segment; fully as high as the anterior organ and of about the same diameter; sides bulging in the middle and curving inward at top, surrounding a sunken tip which bears three or four large post-like sensoria, these not overtopping the sides of the organ; no stomal sense organs, guards or stomal ridges visible.

The cephalo-pharyngeal skeleton (Pl. IV, fig. 38) small, but heavily sclerotized and colored; mouth hook small, as deep as long, with a weak secondary tooth on ventral edge; hypostome long and heavy, with the ventral bridge sticking down very sharply below, twice as long as wide; subhypostomal sclerite large and conspicuous; depth of skeleton at dorsal arch only one and one-half times that of the hypostome and very deeply curved along anterior edge of dorsal wing, with a sharp projection at the dorsal arch; dorsal wings nearly three times the combined length of the mouth hook and hypostome; pharyngeal plates with elliptical holes beyond the middle; parastomals present.

The anterior respiratory organ of average size (Pl. VII, fig. 83), rising somewhat higher than usual above the body; the anterior stigmatic chamber almost square in profile, although distally spreading; reticulum with irregular hexagonal meshes, four or five across one side of the chamber; external organ elliptical in general outline, with ten widely separated tubules across one side, ellipse about twice as wide as deep and the external part somewhat deeper than the stigmatic chamber; tubules short and thick, only one and one-fourth times as long as the diameter, each with a flattened rounded tip with a large area of granulation.

In posterior view, the last segment (Pl. XI, fig. 147) without tubercles or papillae but with various rolls giving it a tumid appearance; stigmatic area rather low with its ventral margin just about touching the transverse mid-line; spiracular plates evident but small and separated only about twice the length of a slit ventrally, while spreading somewhat dorsally, lying exactly on the ventral margin of the stigmatic area; the depressions tending to give off little branches running into the edges of the neighboring high rolls, but little enough of distinction in this segment; posterior spiracles slightly raised.

The posterior stigmatic chamber (Pl. XV, fig. 185) elongate, distal wall scarcely kidney-shaped and with a reticulum of irregular, large, hexagonal meshes, only four or five across the narrow side; the true slit long and narrow, more than four times longer than wide; slit walls massive thus giving the general impression of slits nearly as wide as long, outline of wall a smooth regular oval but with scalloped inned edge, six or seven weak teeth projecting into the cavity; interspiracular processes small, composed of two to four fingers most of which are widely lanceolate and unbranched, one individual finger with a notch at tip so deep as to form two short branches, fingers about one half as long as the slit.

Recognition characters.—(1) Spinules are not set in lines as in many species. (2) Interspiracular processes are made up of two to four lanceolate fingers, seldom branched. (3) Massive slit wall is evenly oval in its outside appearance but scalloped on inner edge. Each side of wall is wider than the opening of the slit. (4) Neither tubercles nor papillae are seen on caudal segment.

Trupanea subpura (Johnson)

1909. *Euaresta subpura* Johnson, Psyche, XVI, p. 114.

The type specimens of this species were taken on the Sea burweed (*Xanthium echinatum* Murr.), by Mr. Johnson at Wildwood and Angelsea, New Jersey. Benjamin (1934, p. 59) recorded them from *Baccharis glomeruliflora* Pers. The larvae feed in the young and tender stems where they tunnel out as much as an inch of stem and where they usually form slight swellings.

Described from two specimens taken from *Baccharis glomeruliflora* Pers. at W. Malabar, Florida on May 3, 1931 and lent to the author by the United States National Museum.

The maggots are about 4.5 mm. in length by 1.5 mm. in diameter.

Spinules minute, sharp-tipped cones, not arranged in rows or lines, but spaced uniformly over the spinulose areas; such areas in the form of irregular bands, rather narrow in cephalic region and much wider caudally.

Anterior sensory organ very small, of a single segment, large at base and narrowing until tip little more than half the basal diameter, a collar projecting only slightly over the distal rim; posterior organ, on the other hand very large, about three times longer and more than twice the diameter of the anterior sensory organ; the posterior one barrel-shaped, with three or four long sensoria projecting from its distal end; no stomal sense organs, guards or stomal ridges observed.

Cephalo-pharyngeal skeleton (Pl. IV, fig. 39) small but massive, with much color and sclerotization; mouth hook deeper than long with a sharply curved projection at the dorso-caudal corner and with the dorsal outline strongly curved anteriorly, tip quite sharp and with a tooth of about the same shape as the tip, lying close to the anterior extremity; hypostome very large, two-thirds as deep as the mouth hook and fully twice as long as wide, the ventral bridge sharply projecting downward; parastomals lacking; subhypostome very large and heavy; pharyngeal skeleton at dorsal arch not one and one-half times the depth of the touching hypostome; dorsal wing about one and one-half times the length of the mouth hook and hypostome combined; pharyngeal plate with a large hole near caudal extremity.

The anterior respiratory organ (Pl. VIII, fig. 84) vase-shaped with a narrow base, becoming gradually wider throughout the region of the stigmatic chamber and with the external part spreading slightly; six or seven large tubules with bulged sides, rounded tips and small clear channels running from the tips almost through the tubules, outer half with an area of heavy granules around the channels; stigmatic chamber with a reticulum of sub-circular meshes, five across the narrow base and nine to twelve filling the gap at the large end.

The posterior view (Pl. VIII, fig. 94) of the last segment round and tumid, with no tubercles but with a heavy stippling of spinules, although none on the stigmatic area; this area lying with its ventral border just touching the transverse mid-line; no spiracular plate visible in this view but the slits situated five times the length of one apart on the ventral end and spreading to about seven lengths apart dorsally.

In magnification, the posterior spiracle (Pl. XVI, fig. 186) showing a small plate and a small stigmatic chamber; reticulum with circular meshes scarcely crowded, about five across the narrowest part, the marginal area of radiations wider than usual; slits very long and narrow, at least six times longer than wide; slit walls heavy, giving slits a truncated appearance; no teeth, but only

slight wavy undulations; interspiracular processes small but the fingers nearly half as long as a slit, composed of from four to six fingers, broadly lanceolate, each with a line visible through the middle resembling the mid-vein of a plant leaf; a few fingers branched very close to the base.

Recognition characters.—(1) The cephalo-pharyngeal skeleton is small but heavily built. (2) Anterior respiratory organ has elongate clear channels down the center of the tubules. (3) Many minute spinules surround the stigmatic area in a wide band. (4) Spiracular slits are six times longer than wide with a heavy irregular wall which gives a rectangular outline. (5) Interspiracular processes are small, each with four to six boat-shaped fingers with a dark line down the center of each. Fingers are rarely branched.

Trypeta florescentiae (Linnaeus)

1758. *Musca florescentiae* Linnaeus, Syst. Nat., (10), p. 601.

The "Thistle maggot" has been reared from several species of thistle in this country. It has been taken in Nova Scotia, Maine, Massachusetts and New York, while specimens from Oregon are certainly identical with the eastern thistle fly. The adults are very commonly taken on the Canadian thistle when it is slightly past its prime in blooming. The young maggots develop among the achenes and, according to Detmers (1927, pp. 26-29) eat their way from the outside into the seed. The fact that the females are so plentiful around the flowers when the achenes are too small for deposition of eggs, helps to corroborate this statement. When full-grown, the maggot crawls out of the seed and constructs an envelope for itself, made of the thistle silk which has been tangled and glued together by the larva. This forms the protective covering for over-wintering in the thistle heads. One to four larvae may be found in a single head.

Described from a large number of specimens taken from thistle at Ithaca, New York, by the author, and others collected by S. C. Jones in thistle in Oregon.

Larvae measure from 5 to 6 mm. in length by 1.5 mm. in diameter; the front end tapering, but strongly truncated caudally, most of the caudal end very dark brown in color; eight or nine fusiform areas visible to the naked eye, but these not entirely outlining the spinulose bands.

Many specimens bearing low, round spinules with sharp tips, others possessing no spinules; some larvae with such wide spinulose bands that the body is nearly solidly covered, while others have only a sparse stippling; specimens taken in 1921 in the so-called bull thistle more spinulose than those taken on Canadian thistle in 1927.

Rather small anterior sensory organs present, of one segment only, but with a collar on the tip, organ about twice as high as wide and with the basal third surrounded by an especially heavy bank of chitin; posterior sense organ considerably wider than the anterior, single segmented and barrel-like in outline, distally, the sunken top with three or four rather long straight-sided sensoria; stomal sense organs and guards absent; four to six inconspicuous and rather short stomal ridges on each side.

Cephalo-pharyngeal skeleton (Pl. IV, fig. 40) of usual size, heavily sclerotized and darkened; mouth hook large, almost as deep as long, tip blunt and broad; hypostome small, two-thirds as long as mouth hook and somewhat longer than deep; pharyngeal skeleton itself large and long, measuring three times the length of the mouth hook and hypostome combined; the irregular prolongations of chitin shown in the figure not necessarily characteristic although present in many specimens; parastomals absent but hypostome visible.

Anterior respiratory organ (Pl. VIII, fig. 85) fan-shaped distally with from eight to ten tubules, the numbers differing sometimes on the two sides; anterior stigmatic chamber narrow and elongate, its reticulum with circles of varying sizes, only two across narrowest part of the chamber and three lying along its greater dimension; stem short, soon flaring to form an area about as deep as the chamber and much wider; tubules not quite as long as the stem, twice as long as wide, bulged in the middle and flatly rounded on the tips, a rather flat and wide clear space surrounded by a narrow band of heavy granules on tip of each tubule.

Caudal end (Pl. VIII, fig. 95) very characteristic, its general truncate appearance and dark coloring making it conspicuous among all the species; stigmatic area deeper than wide, with the spiracles set near its dorsal edge thus placing them in the upper fourth of the caudal aspect; spiracular plates with very little color, the slits apparently surrounded by a clear area, spiracular plates set about as far apart ventrally as the length of one slit, but considerably more separated dorsally; all the ventral part of the caudal aspect thickly dotted with small warts, these even extending over into the stigmatic area, close to the slits; dorsal tubercles inconspicuous, scarcely more than papillae, set somewhat farther apart than the stigmatic plates; a lateral bifid tubercle on the middle transverse line, not placed on the lateral margin itself, but about half way between it and the stigmatic area; a single pair of intermediates just below the lower corners of the stigmatic area in a line below the dorsals; ventral areas lower than usual, actually laterad of the anus, each with one tubercle near its center.

The small spiracular plates of the posterior stigmata (Pl. XVI, fig. 187) almost circular in outline; stigmatic chamber likewise small and with no reticulum visible from the posterior view; spindles prominent; slits more or less elongate, pear-shaped, the larger ends outward, and with a definite notch in their outlines, slits nearly two and one-half times longer than wide; thin slit walls with ten to twelve short pin-like projections, corresponding to the heads of the pins are tiny clear balls or loops, with a few weak teeth across the outer ends; no crossbars; interspiracular processes small and inconspicuous, each made up of four or five short fingers, about as long as the width of the slit, a small clear circular base present in each process, individual fingers broadly lanceolate and never branched.

Recognition characters.—(1) The maggot has black truncated caudal end with heavy stippling of small warts on lower half. (2) Stigmatic area is deeper than wide, lateral tubercles bifid and ventrals placed laterad to the anus. (3) The spiracular slits are pear-shaped, with pin-like projections into them from the weak walls. (4) Interspiracular processes are small, of four or five unbranched lanceolate fingers.

Trypeta palposa Loew

1862. *Trypeta palposa* Loew, Monogr. Dipt. No. Amer., 1, p. 74.

These specimens were collected by Blanton at Babylon, New York and identified by him with a question. The adults have been taken commonly on thistle and recorded from Ohio, Wisconsin, Minnesota, Iowa, Kansas and Massachusetts. Described from four specimens.

Larvae small, measuring 5 mm. in length by 1.5 mm. in diameter; of usual shape and with fusiform areas evident to the naked eye.

Integument delicate but bearing spinules on all fusiform areas; no spinules on first segment; an encircling band between second and third thoracic segments and between thorax and abdomen; dorsal bands composed of only three or four rows of short very sharp spinules, set closely together in slightly wavy rows; fusiform areas large, nearly touching each other and running up the sides of the body decidedly more than half way; about thirteen rows of spinules found in wider bands, and definitely divided into long, but slightly curved lines.

Anterior sensory organ present, two-segmented, the proximal segment wider than long, with a constricted neck, bearing a collar of about two-thirds the diameter of the first segment, above this collar, an elongate bulbous segment, fully twice the length of the basal one; posterior sensory organ of a single segment, wider than the anterior organ and slightly higher than its first segment, five sensory pegs set in flattened and sunken top of the posterior sense organ.

Cephalo-pharyngeal skeleton (Pl. V, fig. 41) rather small and not heavily sclerotized; mouth hook narrow, the tapering tip gently curved downward,

length one and one-half times the width; hypostome long and narrow with the ventral bridge extending noticeably below the rest of the sclerite, nearly three times as long as broad; parastomals and subhypostomal sclerite visible; anterior edge of the pharyngeal skeleton rising abruptly but curving forward over the hypostome, depth at this point three times that of the hypostome; dorsal wing long and slender; pharyngeal plates almost parallel to the wings, but shorter and with an elongate fusiform hole in each outer end.

Anterior respiratory organ (Pl. VIII, fig. 86) perfectly fan-shaped with the flaring line starting at the tracheal trunk and spreading upward and outward simultaneously; anterior stigmatic chamber occupying half the depth of the entire organ and bearing a reticulum with small meshes, four or five rows deep, six meshes wide at tracheal trunk, twelve at body surface; fifteen to seventeen small straight-sided, distally rounded tubules, no clear areas in outer ends of tubules, but rounded groups of heavy granules, heavier layers of chitin along the sides of the tubules near the tips.

Caudal segment (Pl. IX, fig. 97) smooth and almost circular in outline being a bit longer than wide; stigmatic area diamond-shaped, wider than deep; spiracular plates just above the transverse mid-line, about four lengths of one slit apart ventrally and spreading considerably in the dorsal direction; posterior spiracles set on top of a raised portion, which represents the entire stigmatic area; no tubercles nor papillae, but various diamond-shaped depressions, four such lined up in the dorsal area above the stigmata; intermediate area outlined by a definite depression and bearing several sunken spots in the trough of the depression; spiracular plates (Pl. XVI, fig. 188) nearly round and not very large; stigmatic chamber oval in posterior view, with no definite reticulum visible, but with various scattered criss-cross strands of exocuticula; slits long and narrow, rather larger than the average with fairly heavy walls, about five times as long as wide; a few heavy crossbars, not evident at surface, but visible at a deeper level, ten to sixteen teeth projecting along the inner edge of the wall; the lower slits on opposite sides almost in a straight line; small spindles present.

The interspiracular processes very large and conspicuous, forming the really unique feature of this species; a long curved basal piece with a large number of fairly wide fingers, which spread only a little, resembling the teeth of a comb, lying side by side; a few fingers branched near the tip and the branches themselves flaring slightly but still retaining the illusion of the teeth of a comb; fingers not much longer than the width of a slit; the base of the interspiracular process as long as the slit; eight to twenty-two trunks with fifteen to twenty-six branches.

Recognition characters.—(1) Anterior respiratory organ is truly fan-shaped, flaring out from the small base to a spread of five times its width. Fifteen to seventeen small tubules are present. (2) Entire

stigmatic area is raised with spiracles placed upon highest part. Four diamond-shaped depressions are arranged along the top of the dorsal area, while the intermediate area is outlined by a depression which carries eight similar sunken spots along its lower course. (3) Interspiracular processes very long and with a large number of short, mostly straight and unbranched fingers set side by side like the teeth of a comb.

Xanthaciura insecta (Loew)

1862. *Trypeta insecta* Loew, Monogr. Dipt. No. Amer., 1, p. 72.

The fifteen specimens studied were collected by F. S. Blanton, at Tampa, Florida, Sept. 22, 1930. They were taken in the White sticktight, *Bidens leucantha*. This fly has also been collected in Bermuda, the Bahamas, other West Indian Islands, Mexico and South America. The maggots feed in the flowers.

Larvae small, 4 mm. long by 1.5 mm. in diameter; posterior end truncated and bearing a circular dark region, covering three-fourths of the caudal aspect; no fusiform areas indicated.

Spinules broad, small and blunt-pointed wherever found; on the first segment, spinules in very close rows; a narrow band of eight to nine rows around the anterior border of first segment; spinules numerous on the anterior third of the body tending to form bands encircling the body; posteriorly, the bands disappearing and the spinules occurring more or less uniformly over the surface.

Anterior and posterior sensory organs both present; anterior one small, slightly higher than wide and somewhat broader distally than in the proximal part, single-segmented, outer end resembling a flat projecting stopper with six or seven dark spots scattered thereon; posterior sense organ likewise of a single segment but twice as broad and twice as high as the anterior, heavy encircling walls surrounding a sunken area from which protrude three or four post-like sensoria, the longest one near the center; no stomal sense organs or guards visible; stomal ridges not apparent on most slides, but one bearing seven small stomal ridges on one side.

Cephalo-pharyngeal skeleton (Pl. V, fig. 42) small, but fairly heavy; mouth hook somewhat longer than deep with gently bowed outline, bluntly tapering tip, with a prominent tooth about half way between distal point and the projecting ventral corner; hypostome about as long as mouth hook, twice as long as greatest depth and with the bridge prominently projecting downward; elongate subhypostome; main part of pharyngeal skeleton not twice as deep as the hypostome but with wings and plates spreading considerably; pharyngeal plates slightly longer and wider than the dorsal wings, although the wings more heavily sclerotized with long, curved projections of colored areas extending backward; an oval hole occurring in the posterior half of the pharyngeal plate; no parastomals.

Anterior respiratory organ (Pl. VIII, fig. 90) palmate in general shape with anterior stigmatic chamber long and narrow, nearly twice as long as wide, wider near union with tracheal trunk than at outer end; meshes of the reticulum irregularly rounded and heavy-walled; external part of the organ about as high as wide with five to six tubules, each twice as long as wide and strongly bulged near the tip, a wide clear space across the outer end of each tubule, with wide area of heavy granules below.

The caudal end (Pl. IX, fig. 96) very distinctive, showing a large black spot and, under the microscope, heavy dotting of blunt, broad spinules giving the appearance of a pebble-grain surface; a narrow area immediately surrounding the spiracular plate, being clear in color and set in the dark brown spot is very noticeable; also in the brown spot some little distance from the circumference, an interrupted circle of heavier color; caudal segment sub-circular, with characteristic breaks in the smooth lateral outline, where a slightly projecting area is evident; posterior spiracles well above the middle, set rather far apart, the length of a spiracular plate between ventral ends and nearly three times farther apart dorsally; no tubercles or papillae present and only one depression line, lying transversely about half way between the stigmatic area and the anus.

Spiracular plate (Pl. XVI, fig. 189) large, sub-circular; the posterior stigmatic chamber also large and the distal wall nearly circular; no spindles visible and no meshes in the reticulum; slits large, straight-sided, nearly three times as long as wide; slit walls very heavy, fully one-third as wide as the slits, smooth and regular in outline with small, scattered, blunt teeth, five to seven along one side and very rarely a narrow crossbar; interspiracular processes brush-like, each with a heavily colored basal cresent, holding a rather large, clear, circular drop in its arms; eight to ten trunks with fifteen to nineteen branches, nearly all occurring just about half way down the finger; interspiracular processes fully half as long as spiracular slits.

Recognition characters.—(1) The caudal end of the larva is blunt and bears a large, dark brown blotch in the center. (2) The mouth hook has a large tooth on the ventral margin. (3) The anterior respiratory organs are palmate with five or six tubules and a long, vase-shaped stigmatic chamber. (4) No tubercles or papillae are present on the caudal end, but a transverse line lies mid-way between stigmatic area and anus. (5) No reticulum visible in the posterior stigmatic chamber. The slit walls are extremely heavy. Interspiracular processes project from heavy basal crescents and are composed of branched needle-like fingers. (6) Caudal end is heavily covered with stout, short and blunt spinules, giving a pebble-grain appearance to the surface.

Zonosemata electa (Say)

1830. *Trypeta electa* Say, Jour. Acad. Nat. Sci. Phila., VI, p. 185.

The "Pepper maggot" is a serious pest of peppers and egg plants in some sections of the country. Burdett (1935, p. 4) states that the larvae lived on the wild plant called Horse nettle, *Solanum carolinense* Linn. in its native haunts and when the weed was destroyed, it changed its host and moved over into the cultivated peppers and egg plants. The female deposits her eggs in peppers when the fruits are from one to one and a half inches in diameter. She makes many punctures without laying eggs, but when satisfied with a hole she usually lays one egg, but may sometimes place as many as ten in a single puncture. Larvae hatch when peppers are two-thirds grown and immediately crawl into the spongy placenta, where they feed. The maggots eventually eat most of this away, causing premature dropping of the fruit. When full-grown, the maggots pupate in the ground, from twelve to fourteen inches below the surface. Benjamin (1934, p. 20) gives the distribution as extending from New York to Indiana and southward to Florida and Texas.

Described from a large number of specimens from Burdett, collected at Salem, New Jersey, in pepper in August, 1932.

Individual larvae very large, 10 to 12 mm. long and 3.4 mm. in diameter; white and resembling maggots of flesh flies in superficial appearance; nine noticeable fusiform areas on alcoholic specimens.

Spinules very large and heavy, plentiful and not confined to the fusiform areas; present in the vicinity of the margins of segments, completely encircling the body in every instance; the band on the anterior edge of the first segment of twelve interrupted wavy rows of very closely set spinules, all directed backward, being stronger on the dorsum than on the venter; next intersection with band of eight slightly curved lines, spaced farther apart; on the abdomen, the bands increasing in width in the ventral half, although along the dorsum they are of equal width throughout; in the fusiform areas, as many as twenty lines occur making the spinulose areas fully as wide as the bare places between.

Anterior sense organs two-segmented, the basal one straight-sided, slightly wider than long, but the second globular, of about one-half the diameter of the basal segment; the posterior sensory organs wider than the anterior and about the same height, sides bulged in the middle, heavily sclerotized and with a group of five or six projecting sensoria on the distal surface; no stomal sense organs or guards; six weak stomal ridges.

Cephalo-pharyngeal skeleton (Pl. V. fig. 44) large, but not abnormally so for such a large species; very long dorsal wings, much longer than pharyngeal

plates; mouth hook about as deep as long but with a very strong notch in the ventral surface setting the distal area off from the wide base; epistomium narrow, horseshoe-shaped with four clear spots; parastomals not usually observed, but one specimen of the twelve slides showing this sclerite to be rather short and weakly chitinized; hypostome small, scarcely more than two-thirds the length of the mouth hook and about two-thirds as deep as long; main pharyngeal skeleton narrow at point of the dorsal arch, but with the wings strongly arched above; no subhypostome visible although several specimens mounted in positions which should have demonstrated this structure had it been present; dorsal wings about five times as long as the mouth hook.

Anterior respiratory organ (Pl. VIII, fig. 89) fan-shaped, externally flaring; anterior stigmatic chamber large, reticulum with small irregular rows of hexagonal meshes about fourteen across at union with the tracheal trunk and twenty-eight to thirty across distal wider portion; external organ wide but low, twenty-seven to thirty-two small tubules, mostly straight-sided somewhat crowded and about one-third as long as the stem, with visible clear areas at tips.

The caudal end (Pl. VIII, fig. 93) of this species quite characteristic and unlike any others; many punctate depressions scattered over the area between the intermediate tubercles and the ventrals; stigmatic area ovate with a steep depression marking its dorsal margin, the whole set well above the middle line; posterior spiracular plates set about twice the length of one slit apart ventrally and slightly farther apart dorsally; dorsal tubercles set close to the dorsal margin of the stigmatic area, directly above the stigmata; one pair of intermediate tubercles lying exactly on the ventral boundary of the stigmatic area and directly under the posterior spiracles; a second pair of intermediates lying slightly ventrad and laterad of the first pair; lateral tubercles very conspicuous, two on each side, cutting into the regular outline of the segment; in the ventral region, some noticeable differences as compared to other species, area divided by a transverse depression, leaving a pair of bifid tubercles, one on each side, far apart and some little distance from the anal region, and below the depression, almost touching it and far toward the lateral border, a second pair of papillae, while a third pair almost directly below the bifurcate ventrals already mentioned.

Spiracular plate of the posterior stigmata (Pl. XVI, fig. 191) rather small, kidney-shaped and not conspicuous; distal wall of the stigmatic chamber, long, narrow, kidney-shaped, with small hexagonal meshes in reticulum, eight extending across the narrowest part; long and narrow spindles evident; spiracular slits long and narrow, about six times as long as wide; walls of average thickness with many interlocking crossbars, a few rather weak teeth between the bars; interspiracular processes somewhat larger than average with elongate crescent-shaped bases; fingers needle-like, branched, eight to thirteen trunks with twelve to twenty-one branches; not very distinctive posterior stigmata.

Recognition characters.—(1) The very large larvae resemble those of flesh flies. (2) The caudal aspect bears many unique tubercles and the lower central expanse is stippled with punctate depressions. (3) The anterior respiratory organ is composed of very short, widely spreading stem, with an undulating outline. Twenty-seven to thirty-two tubules are present.

Zonosemata setosa (Doane)

1899. *Spilographa setosa* Doane, Jour. N. Y. Ent. Soc., VII, p. 178.

The "Rose-hip fly" has been found in large numbers in individual infestations in New York, Oregon, Washington, Idaho, South Dakota, Michigan and Nova Scotia, so that it stretches across the northern part of the United States from coast to coast and into Canada in the east. These maggots live in the hips of *Rosa mulkana* and other related species of the genus.

Described from twenty specimens taken in rose hips at Amity, Oregon on Sept. 18, 1931 and collected by S. C. Jones.

The specimens measure 8 mm. in length and 1.5 mm. in diameter; a large larva of a yellowish fawn color and showing the usual shape; eight fusiform areas observed in alcoholic specimens.

Spinules very conspicuous, especially on the head and on the anterior half of the abdomen, appearing almost as though made of two parts, a round, heavy basal one with a sharp-pointed cone set on top, the whole often somewhat curved; spinules not confined to fusiform areas across the venter but each band completely encircling the body, being decidedly wider in the fusiform area; spinules most numerous about the middle of the abdominal region, where each band on the venter consists of fifteen to seventeen long rows of slightly curved, almost continuous lines; here the bands of spinules, slightly wider than the bare spaces between; on the dorsal side of the same region, however, the bands narrowing to five or six sparse rows and only half the width of the same bands on the ventral side; the anterior marginal area of the first segment with six rows of spinules in almost continuous, noticeably curved and wavy rows, made up of heavy, closely set spinules all directed backward.

The anterior sense organs two-segmented, basal one a low cylinder twice as wide as deep, drawn into a distal short neck of one-half its basal diameter, on top of this constricted part, a globular segment projecting slightly beyond the limits of the neck, but even so, much smaller than the diameter of the basal segment; the posterior sense organ much larger, single-segmented and about as high as wide, distally, the heavily sclerotized circumference enclosing four or five strong sensoria rising from a depressed area to above the level of the rim; no stomal sense organs or guards seen; stomal ridges prominent, nine to twelve on each side.

Cephalo-pharyngeal skeleton (Pl. V, fig. 45) very massive, stout and heavily sclerotized; mouth hook with gently convex outline, the tooth gradually narrowed and blunt at the tip, depth at proximal edge not so great as the length; hypostome considerably smaller than the mouth hook, slightly longer than deep; parastomals strong and subhypostomal sclerite straight and conspicuous; epistome visible from dorsal side, more nearly straight than usual, showing four clear spots; the anterior margin of the pharyngeal skeleton about as deep as the hypostome, but the rise to the dorsal arch very abrupt, making the height at this point, three times that of the hypostome; pharyngeal plates no longer than the combined length of hypostome and mouth hook, although the dorsal wings somewhat longer than the plates.

Anterior respiratory organ (Pl. VIII, fig. 87) rather large, fan-shaped, flared at the sides, with about twenty-seven crowded tubules; stigmatic chamber about as high as wide; reticulum of sub-rectangular meshes in proximal area, running into a more irregular patch toward the exterior; tubules and attachment showing a depth at narrowest part equal to one-fourth that of stigmatic chamber, with the flared sides fully as deep; tubules rounded in outline with curved sides, clear tipped, with a heavily granular area below.

The caudal segment (Pl. IX, fig. 99) with characteristic features in side view; the posterior stigmata set on a slightly raised stalk, quite unusual in this family; furthermore, in profile a tubercle projecting strongly about half way down the side; from the caudal side, the segment appearing rather rounded and smooth; the stigmatic area set rather near the middle line so the spiracles only a little above; spiracular plates rather noticeable, set two and one-half times the length of a slit apart ventrally, and somewhat more divergent on the dorsal margins; dorsal tubercles rather small, set close to the dorsal margin of the stigmatic area and much farther apart than the spiracles themselves; lateral tubercles placed as usual; intermediates bifid, placed on prominent mounds, slightly farther apart than the spiracles, this intermediate bifid tubercle prominent in side view; ventral tubercle unique, possessing three papillae set close together immediately below the intermediates.

The posterior spiracular plates (Pl. XVI, fig. 192) easily visible, rather large and almost round; the distal wall of the stigmatic chamber large and kidney-shaped, reticulum with large hexagonal meshes, about six across the narrowest width; spindles prominent, rather wide; slits long and narrow, about seven times as long as wide; wall only moderately thick with many interlocking cross-bars, also a large number of weak teeth, twelve to fourteen along one side; interspiracular processes rather small, about one-fourth as long as one slit, five to eight trunks with nine to eleven branches, each finger lanceolate in general outline, branching in distal third of the process, thin, weakly-sclerotized crescent-shaped bases.

Recognition characters.—(1) The cephalo-pharyngeal skeleton is massive with the width at the dorsal arch three times that of the hypostome. (2) The anterior respiratory organ is fan-shaped but strongly flaring on sides with twenty-seven small crowded tubules. (3) Posterior stigmata are set on short stalks with their inner edges raised. (4) Each ventral tubercle bears three papillae.

Zonosemata sp.

Described from several specimens taken in New Mexico and lent to the author by O. A. Johannsen. The mounted preparations measure 7 mm. in length by 5 mm. in diameter.

Spinules very prominent and much larger than usual, circular at base but tapering gradually to a sharp and prolonged peak, fully twice as long as the basal diameter; seventeen to twenty spinules set very close together in long curved lines sometimes running into each other; wider bands with ten to twelve rows of these lines farther caudad making the spinulose areas as wide as the regions between; the first segment with a band of some seven lines in closely-set rows, with the spinules even more closely spaced; all spinulose bands encircling the body.

Anterior sensory organ composed of two segments, the basal one nearly as long as thick with the second about half the diameter and height of the first; distal segment dome-shaped; posterior sense organ much bigger in every dimension, being slightly greater in diameter than in height, straight-sided and flat on top, with no sensoria projecting beyond rim, cross-section showing five sunken sensoria at outer extremity; stomal sense organs also present but no guards seen, and only three or four widely spaced stomal ridges.

The cephalo-pharyngeal skeleton (Pl. V, fig. 43) large and massive but not heavily sclerotized or colored; mouth hook decidedly larger than that of any other trypetid studied, much longer than wide, distally gradually narrowing, with its tip turning suddenly downward; hypostome three-fourths as deep as the mouth hook, a little longer than its depth, a very strongly projecting bar on the ventral margin representing the very wide connecting bridge, measuring nearly one-third the length of the entire hypostome; subhypostome tiny and inconspicuous; no indications of parastomals; depth of pharyngeal skeleton at dorsal arch more than three times that of hypostome at its union with the pharyngeal skeleton; dorso-anterior corner of the dorsal wing very ragged and a narrow piece projecting forward; dorsal wings not much longer than the combined length of the mouth hook and hypostome; pharyngeal plates about same length as the dosal wings, and lying almost parallel to them.

The anterior respiratory organ (Pl. VIII, fig. 88) with a cylindrical, almost straight-sided stigmatic chamber, scarcely as deep as wide; reticulum with tiny, heavy-walled subrectangular meshes, twelve to fifteen across one side; the external part of the organ flaring at sides, making a wide notch in the distal edge; twenty-three short, straight-sided tubules only slightly crowded, these half the length of the stem and bearing neither clear spots nor heavy granular areas at tips.

Entire posterior aspect (Pl. IX, fig. 98) of the last segment filled with many tubercles and corresponding depressions; spiracular slits scarcely colored and consequently difficult to observe in alcoholic material; small almost circular stigmatic area placed slightly above the middle transverse line; spiracular plates large, nearly parallel and set about twice the length of a slit apart; dorsal tubercles close to the stigmatic area and about as far apart as the spiracular plates; two pairs of laterals, one on the margin and slightly below the stigmatic area, the other half way between the first lateral and the posterior stigmata, but slightly dorsad; the two pairs of ventral tubercles placed far apart, but quite close to the lower edge of the ventral area; intermediates numerous, seven distinct papillae, a single one on the mid-vertical line, surrounded by three pairs, spaced evenly around this central one.

Large, sub-circular spiracular plate (Pl. XVI, fig. 190); distal wall of the stigmatic chamber large and semi-circular, with a narrow band of radiations around the margin; heavy spindles visible; reticulum with rounded hexagonal meshes, nine to ten stretching across the narrow width; slits very long and narrow, often with an elbow or less prominent change in direction, fully four times as long as wide; slit wall of average width, with many teeth and anastomizing crossbars, ten to fourteen across one side.

Interspiracular processes small, with a small crescent-shaped basal piece plainly visible, one-fourth the length of one slit, of four to ten narrow needle-like fingers, only slightly curving in outline and seldom branched.

Recognition characters.—(1) The mouth hook of cephalo-pharyngeal skeleton is the largest of any of the species studied. (2) The slits are very long and narrow with sudden changes in direction. Many crossbars as well as small teeth are present. (3) Interspiracular processes are small, one-fourth the length of a slit, of four to ten needle-like mostly unbranched fingers. (4) Seven intermediate papillae are arranged in a circle of six around a central one.

Glossary

Anal elevation. The circular elevated area in the larva of certain species, having in its center the anal opening.

Anal lobes. A pair of fleshy processes usually visible at sides of anus, but sometimes retracted or drawn inside the anal opening.

Anterior sensory organs. A pair of minute appendages lying close together and farther from the mouth hooks than the other sense organs. These may consist of one, two or three segments. They do not bear peg-like sensoria distally.

Atrial reticulum. The spongy mass of exocuticula inside the stigmatic chamber which acts as a filter to exclude dirt from the trachea.

Atrium or *stigmatic chamber.* The chamber formed by a secondary invagination of the body wall in which the tracheal trunk terminates.

Branches. The secondary divisions of the interspiracular processes.

Button. A scar marking the place where the trachea opened in the previous instar.

Cephalo-pharyngeal skeleton. A sclerotized framework in the anterior end of the larva, consisting of mouth hooks, hypostomium and pharyngeal skeleton. Mouth hooks are used in food-getting while other parts serve for muscle attachments.

Collar. A projection encircling the anterior sense organ in some species and lying either between the segments or at the tip.

Dorsal area. Not clearly defined, but that region of the penultimate segment which shows dorsally on the posterior view of the caudal segment. It usually bears one or two pairs of tubercles.

Dorsal pouch. A secondary evagination from the roof of the stomal atrium, bilobed, and carrying the frontal sacs at the inner ends of its wings.

Dorsal wing plates. The large upper plates of the cephalo-pharyngeal skeleton. They represent the sclerotized walls of the dorsal pouch.

Epistomium. A bridge-like piece of the cephalo-pharyngeal skeleton lying in the roof of the stomal atrium.

Finger. An individual part of the interspiracular process. In elaborate instances, it includes a trunk with all its branches.

Fusiform area. An integumental part, characterized by its spindle shape and lying ventrally, between segments. Usually it bears minute ambulatory spinules.

Guards. A pair of heavily sclerotized short teeth, on lateral lips of the mouth. They guide the mouth hooks.

Hypostomium. That conspicuous part of the cephalo-pharyngeal skeleton which lies between the pharyngeal plates and the mouth hook.

Intermediate areas. The paired regions of the caudal aspect, which touch the lateral margins of the median area. They usually bear tubercles which vary in number and kind.

Interspiracular processes. Groups of hair-like projections of the body wall, set between the outer ends of the posterior spiracular slits. These are the "sun-ray" structures of some authors.

Lateral areas. Not clearly defined, but those regions of the penultimate segment which show laterally on the posterior view of the caudal segment.

Lines. Short, curved rows of ambulatory spinules. They may be joined into continuous rows and these arranged in wide spinulose bands.

Median area. The middle region of the caudal end, lying immediately below the stigmatic area and above the ventral area.

Mouth hooks. The distal parts of the cephalo-pharyngeal skeleton which extend outside the mouth and tear tissue apart in feeding.

Oral lobes. A pair of semi-circular flaps, extending laterally at the base of the mouth opening. They are often furnished with transverse sclerotized troughs, which guide the liquid food into the mouth.

Papilla. A small, nipple-like elevation at apex of many caudal tubercles, but sometimes found when no tubercles are present. See also *Sense papilla.*

Parastomium. That part of the skeleton lying above the hypostome, parallel to it and attached either to the hypostome or to the dorsal wing, very close to the union of the two.

Pharyngeal plates. See *Posterior pharyngeal plates.*

Pharyngeal skeleton. That part of the cephalo-pharyngeal skeleton composed of the dorsal wings and the posterior pharyngeal plates.

Posterior pharyngeal plates. The elongate and broad parts of the cephalo-pharyngeal skeleton which strengthen the side walls of the pharyngeal cavity.

Posterior sensory organs. A pair of minute sense organs lying immediately below the anterior ones. Usually each consists of a single segment with several minute sensoria on the distal end.

Posterior stigmatic plate. An area visibly outlined by added layers of exocuticula, making up the posterior stigmatic chamber, hence not a true plate. Its area includes the three spiracular openings, the scar and the interspiracular processes of one side.

Reticulum. See *Atrial reticulum.*

Scar. See *Button.*

Sense papilla. A minute sensory organ on the head of a trypetid larva. Three kinds are found, the anterior, the posterior and the stomal sense organs or papillae.

Slit wall. The heavy margin of the spiracular slit or opening, in the posterior stigmata.

Spiracular openings. Microscopic openings into the tubules of the anterior respiratory organ.

Spindles. The surface manifestations of the enlarged lobes of the posterior stigmatic chamber which show around the slits. They often appear to be made up of radiating lines.

Spinules. Microscopical projections of the integument, which usually aid in locomotion.

Spiracular plate. See *Posterior stigmatic plate.*

Stem. The part of the anterior respiratory organ between the stigmatic chamber and the tubules.

Stigmatic area. The region of the caudal aspect bearing the posterior stigmata. It is usually clearly outlined and never bears tubercles.

Stigmatic chamber. See *Atrium.*

Stomal cavity. The mouth cavity, formed in the anterior region of the larvae of higher Diptera when the head is invaginated.

Stomal ridges. The ridges between troughs in the lateral lips of the mouth, ventrad to the guards. These troughs guide the liquid food into the mouth cavity.

Stomal sense organs. A pair of minute sense organs, lying one on each side of the mouth opening.

Subhypostomium. A V-shaped or paired piece of the cephalo-pharyngeal skeleton lying in the floor of the stomal atrium. The apex of the V lies between the posterior ends of the mouth hooks and each arm of the V articulates with the hypostome.

Trunks. The primary divisions of the interspiracular processes.

Tubercles. Elevations or mounds present on the caudal end. They often bear distinct papillae at tips.

Tubules. The small projected ends of the anterior respiratory organs, generally arranged in an irregular row.

Ventral area. The ventral region of the caudal aspect.

List of Those Species of Which the Host Plants are Known

1. **Acanthiophilus helianthi** Rossi. *Amberboa lipii, Carthamus tinctorius* (Hendel, 1927), *Centaurea aegyptica, C. aspera* (Seguy, 1932), *Centaurea friederici* (Hendel, 1927), *Centaurea jacea, C. maculosa, C. nigra, C. ornata, C. pallescens, Cirsium Lanceolatum, Leuza conifera, Onopordum illyricum* (Seguy, 1932), *Silibum marianum* (Hendel, 1927)

   Acanthiophilus helianthoides Bezzi. See 281a. **Sphenella helianthoides** Bezzi

3. **Acanthiophilus hemimelas** Bezzi. The Black and white gall-fly. *Brachylaena* sp. (Munro, 1926)
4. **Acanthiophilus muiri** Bezzi. The Brachylaena gall-fly. *Brachylaena elliptica, B. discolor* (Munro, 1935)
6. **Acanthiophilus ochraceus** Loew. *Emilia flammea* (Munro, 1935), *Senecio angulatus* (Munro, 1926), *S. Burchelli* (Munro, 1935), *S. concolor* (Munro, 1929), *S. elegans, S. erubescens* (Munro, 1935), *S. orbicularis* (Munro, 1929), *S. paniculatus, S. pellucidus* (Munro, 1935), *S. quinquelobus* (Munro, 1926), *S. speciosus* (Munro, 1935)

7. **Acanthiophilus semisphenella** Bezzi. *Senecio trifurcatus* (Munro 1926)
8. **Acanthiophilus walkeri** Wollaston. *Galactites tomentosa* (Hendel, 1927)
9. **Acidia cognata** Wiedemann. *Adenostyles calcaria, Arctium lappa* (?), *Homogyne alpina, Petasites frigidus, P. hybridus, P. niveus* (Hendel, 1927), *Tussilago Farfara* (Seguy, 1932)
10. **Acidia fratria** Loew. *Cryptotaenia canadensis, Heracleum lanatum, Pastinaca sativa, Prenanthes canadense* (Frost, 1924)

Acidia heraclei Linnaeus. See 236. **Philophylla heraclei** Linnaeus

11. **Acidia lucida** Fallen. *Arctium Bardana, A. majus, Helianthus tuberosus, Petasites frigidus, P. niveus, P. officinalis, Tussilago Farfara* (Frost, 1924)
12. **Acidia tussilaginis** Fabricius. *Tussilago Farfara* (Frost, 1924)
13. **Acidogona melanura** Loew. *Hieracium argyraeum, H. Gronovii, H. scabrum* (Benjamin, 1934)

13a. **Acinia biflexa** Loew. *Inula britannica* (Hendel, 1927)

14. **Acinia fucata** Fabricius. *Pluchea foetida, P. imbricata, P. purpurascens* (Benjamin, 1934)
15. **Aciura aplopappi** Coquillett. *Aplopappus pinifolius* (Coquillett, 1894)
16. **Aciura coryli** Rossi. *Phlomis fruticosa* (Seguy, 1932), *Siderites scardica* (Drenski, 1931)
17. **Aciura femoralis** Robineau-Desvoidy. *Phlomis fruticosa* (Townsend, 1893)
18. **Aciura haematopoda** Bezzi. *Barleria obtusa* (Munro, 1935)

Aciura limata. See 176. **Myoleja limata** Coquillett

19. **Aciura maculata** Cole. *Amelanchier* sp. (Cole & Lovett, 1919)
20. **Aciura oborinia** Walker. *Crabbea angustifolia, C. hirsuta* (Munro, 1929)
21. **Aciura rotundiventris** Fallen. *Angelica sylvatica*, Burdock (Pearce, 1928)

Aciura (Eucosmoptera) tetraspina Phillips. See 443. **Xanthaciura tetraspina** Phillips

22. **Aciura tibialis** Robineau-Desvoidy. *Lavandula coronopifolia* (Efflatoun, 1924)
23. **Acropteromma munroanum** Bezzi. The Dog-plum fruit-fly. *Ekebergia capensis* (Munro, 1926)
25. **Actinoptera discoidea** Fallen. *Antennaria margaritacea, Helichrysum arenarium* (Seguy, 1932)
26. **Actinoptera filaginis** Loew. *Filago arvensis, Helichrysum microphyllum* (Seguy, 1932)
27. **Actinoptera mamulae** Frauenfeld. *Helichrysum angustifolium, H. rupestre, H. stoechas* (Seguy, 1932)

27a. **Actinoptera peregrina** Adams. *Helichrysum foetidum* (Munro, 1935)

27b. **Actinoptera rosetta** Munro. *Helichrysum kraussii* (Munro, 1935)

28. **Adrama determinata** Walker. Tea (Munro, 1925)
29. **Afreutreta bipunctata** Loew, Two-spotted gall-fly. *Brachylaena discolor, B. elliptica* (Munro, 1935)

31. **Afreutreta discoidalis** Bezzi. *Vernonia anisochaetoides* (Munro, 1935)
32. **Afreutreta frauenfeldi** Schiner. *Tarchonanthus camphoratus, T. trilobus* (Munro, 1935)
33. **Afrodacus biguttulus** Bezzi. *Olea foveolata, O. laurifolia, O. verrucosa, O. Woodiana* (Munro, 1925)
34. **Anastrepha acidusa** Walker. *Eugenia Jambos, Mangifera indica, Psidium Guajava, Spondias mombin, S. lutea* (Greene, 1934)
35. **Anastrepha braziliensis** Greene. Grapefruit, plum (Greene, 1934)
36. **Anastrepha consobrina** Loew. *Passiflora edulis* (Greene, 1934)
37. **Anastrepha distans** Hendel. Mango (Aldrich, 1924)
39. **Anastrepha fraterculus** Wiedemann. *Amygdalus Persica* (Hendel, 1912), *Anona Cherimola* (Rust, 1918), *A. Humboldtiana* (Greene, 1929), *Birnen* sp., *Citrus Aurantium* (Hendel, 1912), *C. decumana, C. japonica, C. medica limonium, C. nobilis* (Rust, 1918), *Coffea arabica*, Cuban plum *Sapodilla* (Greene, 1929), *Eriobotrya japonica* (Barton, 1931), *Eugenia Jambos* (Wolcott, 1924), *E. malaccensis* (Greene, 1929), *E. uniflora* (Newell, 1930/32), *Feijoa selowiana Ficus Carica* (Rust, 1918), Grape (Greene, 1929), Grapefruit, *Inga* sp. (Greene, 1934), Japanese persimmon, Japanese plum, Jobo amarillo, Jobo de la India, *Mangifera indica* (Greene, 1929), *Persea americana* (Rust, 1918), *Phylocalyx* sp. (Pierce, 1917), *Prunus Armeniaca* (Rust, 1918), *P. Persica* (Pierce, 1917), *Psidium Araca* (Brèthes, 1920), *P. Cattleianum* (Rust, 1918), *P. Guajava* (Pierce, 1917), *P. lucidium* (Rust, 1918), *P. pomiferum* (Hendel, 1912), *Pyrus communis* (Pierce, 1917), *P. malus* (Kisluik, 1933), *Spondias lutea, S. mombin*, (Greene, 1929), *S. purpurea* (Crawford, 1927), Tangerine (Greene 1929)

39a. **Anastrepha fraterculus** var. **mombinpraeoptera** Sein. *Jambos Jambos, Mangifera indica, Psidium Guajava, Spondias cirouella, S. dulcis, S. mombin, S. purpurea* (Sein, 1933)

40. **Anastrepha grandis** Macquart. *Cucurbita Pepo* (d'Araujo e Silva, 1936), Orange, squash, watermelon (Greene, 1934)
42. **Anastrepha ludens** Loew. *Casimiroa edulis* (Mackie, 1928), Citron (Crawford, 1927), *Citrus aurantifolia* (Pierce, 1917), *C. Aurantium* (Greene, 1929), *C. bigaradia, C. vulgaris* (Crawford, 1927), *Gourania suberosa* (Mackie, 1928), Grapefruit (Greene, 1934), Guinguiles, or Jinicuila, *Malphigia mexicana* (Mackie, 1928), *Mangifera indica*, Plum, *Prunus persica* (Greene, 1929), *Psidium Cattaleianum* (Mackie, 1928), *P. Guajava, Sideroxylon Sapota* (Greene, 1929), *Spondias purpurea* (Crawford, 1927), Sweet lime (Pierce, 1917), Tangerine (Crawford, 1927), *Yucca* sp. (Mackie, 1928)
43. **Anastrepha obliqua** Macquart. *Quararibea asterolepis* (Greene, 1934)
44. **Anastrepha obscura** Aldrich. *Lucuma multiflora* (Greene, 1934)
45. **Anastrepha pallens** Coquillett. *Bumelia angustifolia* (Greene, 1934)
46. **Anastrepha panamensis** Greene. *Chrysophyllum cainito* (Greene, 1934)
47. **Anastrepha passiflorea** Greene. *Passiflora vitifolia* (Greene 1934)

48. **Anastrepha peruviana** Townsend. *Anona Cherimola* (Pierce, 1917), *Citrus* sp. (Munro, 1925), *Psidium Guajava, Prunus persica* (Pierce, 1917)
49. **Anastrepha pseudoparallela** Loew. *Passiflora mucronata* (d'Araujo e Silva, 1936)
50. **Anastrepha montei** Costa Lima. *Manihot palmata* (d'Araujo e Silva, 1936)
51. **Anastrepha serpentina** Wiedemann. *Achras zapota, Chrysophyllum panamense, Mammea americana* (Greene, 1934), *Mimusops* sp. (d'Araujo e Silva, 1936), *Nispero* sp., *Psidium Guajava* (Greene, 1929), *Sapodilla* sp. (Kisluik & Cooley, 1933), Star apple (Greene, 1929)
52. **Anastrepha silvae** Costa Lima. *Inga Lushnathiana* (d'Araujo e Silva, 1936)
53. **Anastrepha soluta** Bezzi. Ameixa do Para, *Eugenia uniflora* (Greene, 1934)
54. **Anastrepha striata** Schiner. *Calyptranthes Tonduzii, Psidium Guajava* (Greene, 1934)
55. **Anastrepha suspensa** Loew. *Achras zapota, Chrysobalanus Icaco, Citrus Aurantium, C. maxima, C. sinensis, Eugenia Jambos, Fortunella margarita, Psidium Guajava, Spondias lutea, Terminalia Catappa* (Greene, 1934)
56. **Anastrepha unipuncta** Sein. *Anona reticulata, Chrysobalanus Icaco, Chrysophyllum Cainito, Citrus Aurantium, C. maxima, C. sinensis, Fortunella margarita, Jambos jambos, Psidium Guajava, Terminalia catappa*, (Sein, 1933)
57. **Anastrepha zeteki** Greene. *Chrysophyllum panamense* (Greene, 1934)
58. **Anomoea albiscutellata** DeMeijere. *Coffea arabica* (Leefmans, 1930)
60. **Bactrocera cucurbitae** Coquillett. *Anona muricata, A. squamosa, A. reticulata* (Woodworth, 1921), Bitter gourd, Cantaloupe (Greene, 1929), *Carica Papaya* (Woodworth, 1921), Chinese cucumber (Back & Pemberton, 1917), *Citrullus vulgaris* (Greene, 1929), *Cucumis Melo* (Back & Pemberton, 1914), *C. sativus* (Greene, 1929), *Cucurbita maxima* (Ponce, 1937), *C. moschata* (Beller & Bhenchitr, 1936), *C. peppo* (Back & Pemberton, 1914), Figs, Gourd (Back & Pemberton, 1917), *Lagenaria leucantha* (Ponce, 1937), *Luffa acutangula, L. aegyptiaca* (Beller & Bhenchitr, 1936), *L. cylindrica, Lycopersicum esculentum* (Ponce, 1937), *Mangifera indica* (Woodworth, 1921), *Momordica charantia* (Beller & Bhenchitr, 1936), *Passiflora laurifolia* (Back & Pemberton, 1917), *Phaseolus vulgaris, Prunus Armeniaca* (Pierce, 1917), *Prunus persica* (Back & Pemberton, 1914), *Psidium Guajava* (Woodworth, 1921), *Pyrus malus* (Pierce, 1917), *Sechium edule* (Hutson, 1930), Snake gourd (Rutherford, 1914), *Solanum melongena, Sycos* sp., Vegetable marrow, *Vigna sinensis* (Back & Pemberton, 1917)

61. **Bactrocera garciniae** Bezzi. Garcinia fruits (Bezzi, 1913)
62. **Calachna gibba** Loew. *Ambrosia artemisiaefolia* (Aldrich, 1929)
Camaromyia conferta Bezzi. See 217. **Parafreutreta conferta** Bezzi
63. **Camaromyia helva** Loew. The Black-spot maggot flower-fly. *Conyza incisa, C. ivaefolia, C. pinnatifida, Nidorella auriculata* (Munro, 1929)
64. **Campiglossa grandinata** Rondani. *Solidago Virgo-aurea* (Seguy, 1932)
65. **Campiglossa irrorata** Fallen. *Artemisia campestris* (?) (Seguy, 1932)
65a. **Campiglossa perspicillata** Bezzi. *Helichrysum cymosum* (Munro, 1935)
66. **Capparimyia savastanii** Martelli. *Capparis spinosa* (Seguy, 1932)
67. **Carphotricha pupillata** Fallen. *Hieracium murorum, H. sabaudum,* (Frauenfeld, 1863), *H. sylvaticum* (Boie, 1847), *H. umbellatum* (Frauenfeld, 1863)
Carpomyia caucasica Zaitz. See 69. **Carpomyia pardalus** Bigot
68. **Carpomyia incompleta** Becker, Naleback fruit-fly of Sudan. *Zizyphus Jujuba, Z. sativa, Z. spina-Christi* (Efflatoun, 1927), *Z. vulgaris* (Seguy, 1932)
69. **Carpomyia pardalus** Bigot. Cucumber (Cleghorn, 1914), *Ecballium elaterium,* Melon (Rekach, 1930), Vegetable marrow (Cleghorn, 1914)
70. **Carpomyia schineri** Hendel. *Rosa canina, R. gallica* var. *damascena, R. pimpinellifolia* (Seguy, 1932), *R. spinosissima* (Hendel, 1927)
71. **Carpomyia vesuviana** A. Costa. *Zizyphus Jujuba, Z. sativa* (Hendel, 1927), *Z. vulgaris* (Seguy, 1932)
74. **Carpotricha guttularis** Meigen. *Galium verum* (Pearce, 1928)
75. **Ceratitis aliena** Bezzi. *Solanum nigrum* (Munro, 1935)
75a. **Ceratitis annonae** Graham. The Anona fruit-fly. *Anona muricata,* Cacao pods (Pierce, 1917), *Psidium Cattleianum* (Silvestri, 1914), *P. Guajava* (Pierce, 1917), *Spondias lutea* (Bezzi, 1913)
75b. **Ceratitis bipustulata** Bezzi. *Capparis corymbifera* (Munro, 1935)
76. **Ceratitis capitata** Wiedemann. The Mediterranean fruit-fly. *Aberia caffra, Achras Sapota* (Silvestri, 1914), *Amygdalus Persica, Anona muricata* (Pierce, 1917), *Arbutus unedo* (Munro, 1929), *Arenga saccharifera* (Severin, 1913), *Argania Sideroxylon, Armeniaca vulgaris* (Seguy, 1932), Asparagus (Munro, 1925), *Atropa Belladonna, Averrhoa Carambola* (Silverstri, 1914), Barbados gooseberry (Froggatt, 1909), *Callophyllum inophyllum, Capsicum* sp., (Pierce, 1917), *Carica Papaya, C. quercifolia, Carissa arduina* (Severin, 1913), *C. grandiflora* (Munro, 1935), *Cerasus vulgaris* (Seguy, 1932), *Cestrum* sp. (Severin, 1913), Chillies (Gurney, 1912), *Chrysobalanus ellipticus, C. Icaco* (Silvestri, 1914), *Chrysophyllum aryrophyllum* (Munro, 1935), *C. Cainito* (Severin, 1913), *C. Icaco* (Efflatoun, 1924), *C. oliviforme* (Severin, 1913), *C. viridiflorum* (Munro, 1929), Citron (French, 1907), *Citrus Aurantium, C. aurantium sinense* (Severin, 1913), *C. buxifolius* (Greene, 1929), *C. decumana* (Severin, 1913), *C. grandis* (Pierce, 1917), *C. japonica* (Severin, 1913), *C. limonia* (Pierce, 1917), *C. medica limetta, C. nobilis* (Severin, 1913), Coco-plum (Froggatt, 1909), *Coffea arabica* (Pierce,

1917), *C. liberica* (Severin 1913), *Cucurbita* sp. (Efflatoun, 1924), *Cydonia oblonga* (Greene, 1929), *C. vulgaris* (Seguy, 1932), *Diospyros decandra* (Severin, 1913), *D. kaki* (Pierce, 1917), *D. mespiliformis*, *Doryalis caffra*, *Ekebergia capensis* (Munro, 1925), *Eriobothria japonica* (Greene, 1929), *Eugenia braziliensis*, *E. Jambos*, *E. malaccensis*, *E. uniflora*, *Ficus carica* (Silvestri, 1914), Granadillas (Froggatt, 1909) *Herpephyllum caffrum* (Munro, 1925), *Jambosa malaccensis* (Severin, 1913), *Limonium deliciosa*, *L. medica* (Hendel, 1912), *Lycium campanulatum* (Munro, 1929), *Lycopersicum esculentum* (Pierce, 1917), *Maclura aurantiaca* (Gurney, 1912), *Mammea americana*, *Mangifera indica* (Silvestri, 1914), *Mespilus germanica* (Pierce, 1917), *Mimusops Elengi* (Severin, 1913), *M. kirkii* (Munro, 1935), *Murraya exotica*, *Musa Cavendishii* (Severin, 1913), *M. sapientium* (Seguy, 1932), Nectarines (Greene, 1929), *Noronhia emarginata* (Silvestri, 1914), *Opuntia ficus indica* (Hendel, 1927), *O. Tuna*, *O. vulgaris* (Silvestri, 1914), *Passiflora caerulea* (Munro, 1925), *P. foetida* (Hendel, 1927), *P. quadrangularis* (Pierce, 1917), *Peponium Mckennii*, *Pereskia aculeata* (Munro, 1935), *Persea gratissima* (Severin, 1913), *Persica vulgaris* (Seguy, 1932), *Phaseolus vulgaris* (Pierce, 1917), Pineapple (Gowdey, 1913), Plum (Greene, 1929), *Podocarpus elongata* (Munro, 1925), Pompelmoes (Greene, 1929), *Prunus americana* (Pierce, 1917) *P. Armeniaca*, *P. Cerasus*, *P. Persica*, *Psidium Cattleianum*, *P. Guajava*, *Pyrus communis*, *P. Cydonia*, *P. germanica*, *P. Malus* (Silvestri, 1914), *Royena pallens* (Munro, 1935), *R. pubescens*, *Santalum album*, *Sideroxylon inerme* (Munro, 1925), *S. Sapota*, *Solanum capsicastrum* (Pierce, 1917), *Strychnos Atherstoni*, *S. pungens* (Munro, 1925), *Terminalia Catappa* (Severin, 1913), *T. Chebula* (Pierce, 1917), *Thevetia neriifolia* (Severin, 1913), *Vangueria infausta* (Munro, 1925), *Vitis labrusca* (Severin, 1913), *V. vinifera* (Pierce, 1917)

77. **Ceratitis catoirei** Guerin. Granadillas (de Charmoy, 1918), *Mangifera indica* (Munro, 1925), Nectarines, *Psidium Guajava* (de Charmoy, 1918), Tangerines (Pierce, 1917)
78. **Ceratitis citriperda** McLeay. Oranges (Goureau, 1859)
79. **Ceratitis colae** Silvestri. *Cola acuminata* (Silvestri, 1914)
80. **Ceratitis cosyra** Walker. "All kinds cultivated fruits," "Several native wild fruits" (Froggatt, 1909), *Anona senegalensis*, *Sclerocarya caffra* (Munro, 1932)
81. **Ceratitis giffardi** Bezzi. *Chrysobalanus ellipticus*, *Sarcocephalus esculentus* (Silvestri, 1914)
82. **Ceratitis hispanica** Breme. Oranges (Goureau, 1859)
83. **Ceratitis morstatti** Bezzi. *Cola acuminata* (Bezzi, 1913)
84. **Ceratitis nigerrima** Bezzi. *Coffea arabica*, *Eugenia uniflora* (Pierce, 1917)

85. **Ceratitis punctata** Wiedemann, The Cacao fruit-fly. *Conopharyngia* sp. (Bezzi, 1913), *Mangifera indica*, Passion fruit (Pierce, 1917), *Plumeria longiflora* (Silverstri, 1914), *Psidium Guajava* (Pierce, 1917), *Theobroma cacao* (Silvestri, 1914)
86. **Ceratitis rubivora** Coquillett, The Natal fruit-fly. Blackberries (Froggatt, 1909)
87. **Ceratitis silvestrii** Bezzi. *Butyrospermum Parkii, Chrysobalanus* sp. (Pierce, 1917)
88. **Ceratitis stictica** var. **antistictica** Bezzi. *Oxyanthus sulcatus* (Silvestri, 1914)
89. **Ceratitis striata** Froggatt, The Bamboo fruit-fly. Bamboo (Froggatt, 1909)
90. **Ceratitis tritea** Walker. *Pyrenacantha vogeliana* (Silvestri, 1914)
91. **Ceriocera ceratocera** Hendel. *Arctium lappa* (?) (Hendel, 1927), *Centaurea scabiosa* (Seguy, 1932)
92. **Chaetodacus biguttulus** Bezzi. *Olea foveolata, O. laurifolia, O. Woodiana* (Munro, 1924)
93. **Chaetodacus cucurbitae** Coquillett. *Carica Papaya, Cucurbita* sp., *Lycopersicum esculentum, Mangifera indica, Phaseolus vulgaris* (Munro, 1925)
94. **Chaetodacus dorsalis** Hendel. *Eugenia* sp., *Physalis angulata, Solanum* sp. (Fulmek, 1927)
95. **Chaetodacus ferrugineus** Fabricius. *Coffea arabica, Cucurbita* sp. (Munro, 1925), *Eugenia Jambosa* (Fulmek, 1927), *Mangifera indica* (Munro, 1925), *Citrus* sp., *Prunus Persica, Pyrus Malus* (Poohova, 1936)
96. **Chaetodacus ferrugineus dorsalis** Hendel. *Diospyros Kaki, Eriobotrya japonica, Eugenia Jambos, E. javanica, Mangifera indica, Musa* sp., Orange, *Prunus communis, P. Persica, Psidium Guajava* (Shiraki, 1934)
97. **Chaetodacus passiflorae** Froggatt. *Anacardium occidentale, Capsicum grossum, Carica Papaya, Citrus Aurantium, Coffea arabica, C. liberica, Dracontomelon sylvestre, Eugenia malaccensis, Gossypium barbadense, Inocarpus edulis, Mangifera indica, Passiflora quadrangularis, Persea gratissima, Pometia pinnata, Psidium Guajava, P. Cattleianum, Santalum yosi* (Simmonds, 1936)
98. **Chaetodacus xanthodes** Broun. *Anona sativus, Carica Papaya, Citrus decumana* (Simmonds, 1936), Mammee apple (Pierce, 1917), *Passaflora quadrangularis* (Simmonds, 1936), Pineapple, *Psidium Guajava*, Shaddock (Pierce, 1917)
99. **Chaetodacus zonatus** Saunders. Melon (Essig, 1913), *Prunus Persica* (Efflatoun, 1924)

99a. **Chaetorellia jacea** Robineau-Desvoidy. *Centaurea nigra, C. scabiosa, Cirsium lanceolatum* (Hendel, 1927)

99b. **Chaetorellia succinea** O. Costa. *C. Centaurea calcitrapa, pallescens* (Hendel, 1927)

99c. **Chaetostomella onotrophes** Loew. *Arctium lappa, A. tomentosa, Carduus acanthoides, C. crispus, Centaurea carniolica, C. cyanus, C. jacea, C. montana, C. nigra, C. phrygia, C. pseudophrygia, C. scabiosa, Cirsium canum, C. eriophorum, C. lanceolatum, C. oleraceum, C. palustre, Jurinea mollis, Onopordon illyricum, Taraxacum officinale* (Hendel, 1927)

100. **Coelopacidia strigata** Bezzi, Stem-borer fruit-fly. *Senecio juniperinus* (Munro, 1926), *S. scoparius* (Munro, 1929)

101. **Craspedoxantha marginalis** Wiedemann, Gerbera flower-fly. *Berkheya latifolia, Callilepis laureola, C. leptophylla* (Munro, 1929), Dahlia (Munro, 1925), *Dicoma anomala, D. anomala* var. *sonderi, Gerbera aurantiaca* (Munro, 1935), *G. Jamesoni* (Munro, 1925), *G. piloselloides, G. plantaginea* (Munro, 1929), *Vernonia Melleri, Zinnia* sp. (Munro, 1935)

102. **Dacus aequalis** Coquillett, Large Australian fruit-fly. Orange (Froggatt, 1909)

103. **Dacus apoxanthus** var. **decolor** Bezzi, Tomato fruit-fly. *Lycopersicum esculentum* (Munro, 1925)

104. **Dacus armatus** Fabricius. Cucumber, melon (Silvestri, 1914)

105. **Dacus asclepiadeus** Bezzi, The milkweed fly. *Asclepias* sp. (Munro, 1925)

106. **Dacus bipartitus** Graham. Cucumber, melon, *Momordica* sp. (Silvestri, 1914), Vegetable marrow (Patterson, 1914)

107. **Dacus bistrigulatus** Bezzi, The two-grooved milkweed-fly. *Asclepias* sp. (Munro, 1925)

108. **Dacus brevis** Coquillett. *Carallum caudata* (Munro, 1926)

109. **Dacus brevistriga** Walker, The Physocarpa milkweed-fly. *Asclepias physocarpos* (Munro, 1925)

110. **Dacus brevistylus** Bezzi, The Lesser pumpkin-fly. *Asclepias* sp. (Munro, 1925), *Citrullus vulgaris* (Silvestri, 1914), *Coccinea palmata, C. quinqueloba*, Cucumber (Munro, 1925), *Cucumis africana* (Munro, 1926), *C. myriocarpus* (Munro, 1925), *C. metulifera* (Munro 1926), *Lycopersicum esculentum* (Munro, 1929), Melon (Bezzi, 1924), *Momordica involucrata, Phaseolus vulgaris*, Pumpkin (Munro, 1925), *Sechium edule* (Munro, 1929), Spaanspek, Squash, Vegetable marrow (Munro, 1925)

110a. **Dacus ciliatus** Loew. *Coccinea adoenensis* (Munro, 1935)

111. **Dacus ciliatus** var. **duplex** Munro. Calabash, *Citrullus vulgaris, Coccinea palmata, C. quinqueloba*, Cucumber, *Cucumis myriocarpus, Lycopersicum esculentum*, Melon, *Momordica involucrata, Phaseolus vulgaris*, Pumpkin, *Sechium edule*, Spaanspek, Squash, Vegetable marrow (Munro, 1932)

112. **Dacus curvipennis** Froggatt, The Banana fruit-fly. Banana (Froggatt, 1909)

113. **Dacus d'Emmerezi** Bezzi. Pumpkin, Vegetable marrow (de Charmoy, 1918)

114. **Dacus diversus** Coquillett, The Three-striped fruit-fly. *Mangifera indica*, Orange (Pierce, 1917), Plantains (Fletcher, 1919), *Prunus Persica*, *Psidium Guajava* (Pierce, 1917)

115. **Dacus ferrugineus** Fabricius, The Mango fruit-fly. *Calotropis* sp., *Citrus* sp. (Pierce, 1917), *Diospyros Packmanni* (Beller & Bhenchitr, 1936), *Eugenia malaccensis*, *Mangifera indica* (Pierce, 1917), *Musa* sp. (Beller & Bhenchitr, 1936), Orange, *Prunus Persica* (Froggatt, 1909), *Psidium Guajava*, *Sandoricum indicum*, *Solanum*, sp., *Zizyphus Jujuba* (Beller & Bhenchitr, 1936)

116. **Dacus ferrugineus** var. **mangiferae** Cotes. *Mangifera indica* (Bezzi, 1913)

117. **Dacus frenchi** Froggatt. *Artocarpus integrifolia* (Pierce, 1917), Orange (Froggatt, 1909)

118. **Dacus fuscatus** Wiedemann, The Dusky milkweed-fly. *Asclepias*, *Pachycarpus schinzianus* (Munro, 1925), *Xysmelobium undulatum* (Munro, 1929)

118a. **Dacus hamatus** Bezzi. *Sphaerosicyos sphaericus* (Munro, 1935)

119. **Dacus immaculatus** Coquillett, The Unspotted milkweed-fly. *Asclepias* sp. (Munro, 1925), *Coccinea quinqueloba* (Bezzi, 1924)

119a. **Dacus inornatus** Bezzi. *Sphaerosicyos sphaericus* (Munro, 1935)

120. **Dacus longistylus** Wiedemann. *Calotropis procera* (Efflatoun, 1927)

121. **Dacus lounsburyi** Coquillett. *Citrullus vulgaris* (Silvestri, 1914)

122. **Dacus mulgens** Munro. *Asclepias fruticosa*, *Cynanchum obtusifolium* (Munro, 1932)

124. **Dacus oleae** Rossi, The Olive fruit-fly. *Olea chrysophylla*, *O. europaea* (Silvestri, 1914), *O. foveolata*, *O. laurifolia* (Munro, 1924), *O. verrucosa* (Munro, 1925), *O. Woodiana* (Munro, 1929)

125. **Dacus ornatissimus** Froggatt. Mandarine (Froggatt, 1909)

126. **Dacus ostiofaciens** Munro. *Rhaphionacme Galpinii* (Munro, 1935)

127. **Dacus passiflorae** Froggatt, The Fiji fly. Granadilla, Lemon, Lime, Mango, Orange, Shaddock (Pierce, 1917)

127a. **Dacus pectoralis** Walker. *Sphaerosicyos sphaericus*, *Peponium Mckenii*, *P. vogelii* (Munro, 1935)

128. **Dacus persicae** Bigot, The Peach fruit-fly. *Mangifera indica* (Pierce, 1917), Orange (Froggatt, 1909), *Prunus Persica* (Pierce, 1917), *Psidium Guajava* (Froggatt, 1909)

129. **Dacus psidii** Froggatt, The South Sea guava-fly. *Ficus stephanocarpa* (Gurney, 1908), Granadilla, *Psidium Guajava* (Pierce, 1917), *Schizoneria ovata*, *Sideroxylon australe* (Gurney, 1908)

129a. **Dacus punctatifrons** Karsch. *Peponium Mckenii* (Munro, 1935)

130. **Dacus rarotongae** Froggatt, Raratonga fruit-fly. *Mangifera indica* (Pierce, 1917)

131. **Dacus tongensis** Froggatt, The Tonga fruit-fly. *Mangifera indica* (Pierce, 1917)
132. **Dacus tryoni** Froggatt, The Queensland fruit-fly. *Acronychia laevis*, Banana, Cucumber (Pierce, 1917), *Ficus stephanocarpa* (Gurney, 1908), Kumquat, Lemon, Lillipilly (Gurney, 1912), Loquat (Pierce, 1917), *Lycopersicum esculentum* (Froggatt, 1909), *Mangifera indica* (Pierce, 1917), Mandarin (Gurney, 1912), Nectarine, Orange (Pierce, 1917), Plum (Gurney, 1912), *Prunus Armeniaca*, *P. Persica* (Pierce, 1917), *Pyrus communis* (Gurney, 1912), *P. Malus*, Quince, *Schizoneria ovata*, *Sideroxylon australe* (Pierce, 1917)
133. **Dacus tryoni** var. **cucumis** French. Cucumber (French, 1907)
134. **Dacus tsunoonis** Miyake, The Japanese orange-fly. *Citrus* sp. (Poohova, 1936) Mandarin, Orange (Miyake, 1919)
136. **Dacus vertebratus** Bezzi, The Jointed pumpkin fly. *Citrullus vulgaris* (Silvestri, 1914), Cucumber (Munro, 1926), *Cucumis myriocarpus* (Munro, 1929), Vegetable marrow (Munro, 1925)

Dacus xanthodes Broun. See 98. **Chaetodacus xanthodes** Broun.

Dacus zonatus Saunders. See 99. **Chaetodacus zonatus** Saunders.

138. **Ditrichia guttularis** Meigen. *Achillea Millefolium* (Seguy, 1932)
139. **Ditrichia guttulosa** Loew. *Santolina rosemarinifolia* (Seguy, 1932), *S. rosemarinifolia* var. *vulgaris* Boisson (Hendel, 1927)
140. **Dyseuaresta mexicana** Wiedemann. *Melanthera* sp. (Benjamin, 1934)
141. **Ensina anceps** var. **fasciolata** Bezzi. *Aster muricatus*, *Conyza ivaefolia*, *Erigeron linifolius* (Munro, 1926)
142. **Ensina hieroglyphica** Bezzi, Hieroglyphic flower-fly. *Osteospermum moniliferum* (Munro, 1926)
143. **Ensina ignobilis** Loew. *Dimorphotheca* sp. (Munro, 1926)
144. **Ensina ignobilis** var. **plebeja** Bezzi, The Sow-thistle flower-fly. *Dimorphotheca* sp. (Munro, 1926), *Sonchus oleraceus* (Munro, 1925)
145. **Ensina magnipalpis** Bezzi. *Osteospermum moniliferum* (Munro, 1926)
146. **Ensina myiopitoides** Bezzi, The Bitter Karroo bush flower-fly. *Chrysocoma tenuifolia* (Munro, 1925)

Ensina picciola Bigot. See 228. **Paroxyna picciola** Bigot.

147. **Ensina polana** Munro. *Osteospermum moniliferum* (Munro, Bull. Ent. Res. XXII, p. 123)
148. **Ensina sonchi** Linnaeus. *Apargia* sp. (Townsend, 1893), *Aster tripolium* (Hendel, 1927), *Carduus nutans* (Frauenfeld, 1863), *Crepis biennis* (Hendel, 1927), *Homogyne alpina*, *Leontodon autumnale*, *L. hastile* (Frauenfeld, 1863), *L. hispidus*, *Picris hieracioides* (Hendel, 1927), *Podospermum Jacquin* (Frauenfeld, 1863), *Prenanthes purpurea*, *Scorzonera jaquiniana*, *Senecio jacobaea* (Hendel, 1927), *Sonchus arvensis*, *S. oleraceus*, *Tragopogon porrifolius*, *T. pratensis* (Seguy, 1932)
149. **Ensina sororcula** Wiedemann, The Black-jack seed-fly. *Bidens pilosa* (Munro, 1925)

150. **Epochra canadensis** Loew, The Yellow currant-fly. *Grassularia oxyacanthoides* (Gillette, 1892), *Ribes alpinum* (Severin, 1917), *R. grossularia* (Doane, 1899), *R. triste* (Severin, 1917), *R. vulgare* (Doane, 1899).
151. **Euaresta aequalis** Loew, The Cockle-bur fly. *Xanthium* sp. (Marlatt, 1891)

Euaresta araneosa. See 154a. **Euaresta pacifica** Doane.

153. **Euaresta guttata** Fallen. *Anthemis arvensis* (Seguy, 1932), *Chrysanthemum leucanthemum* (Hendel, 1927), *Cirsium palustre* (Seguy, 1932), *Hieracium sabaudum* (Hendel, 1927), *Leucanthemum vulgare* (Seguy, 1932)
154. **Euaresta iphionae** Efflatoun. *Iphiona mucronata* (Efflatoun, 1927)
154a. **Euaresta pacifica** Doane. *Artemisia aromatica, A. dracunculoides* (Felt, 1921)
154b. **Euarestella megacephala** Loew. *Inula crithmoides* (Hendel, 1927)
155. **Euphranta connexa** Fabricius. *Vincetoxicum officinale* (Seguy, 1932)
155a. **Euribia affinis** Frauenfeld. *Centaurea rhenana* (Hendel, 1927)
155b. **Euribia algira** Macquart. *Centaurea sempervirens* (Hendel, 1927)
155c. **Euribia bigeloviae** Cockerell. *Bigelowia graveolens* (Felt, 1918)
156. **Euribia caffra** Loew. *Vernonia fastigiata* (Munro, 1925), *V. lasioclada, V. monocephala* (Munro, 1929), *V. natalensis* (Munro, 1925)
156a. **Euribia cardui** Linnaeus. *Cirsium arvense, C. lanceolatum, C. oleraceum* (Hendel, 1927)
156b. **Euribia congrua** Loew. *Cirsium erisithales, C. oleraceum* (Hendel, 1927)
156c. **Euribia cuspidata** Meigen. *Centaurea calcytrapa, C. jacea, C. montana, C. nigra, C. scabiosa, C. sempervirens, C. serotina* (Hendel, 1927)
157. **Euribia dissoluta** var. **saccata** Bezzi. *Vernonia Steetziana* (Munro, 1926)
157a. **Euribia eriolepidis** Loew. *Carduus defloratus, C. nutans, Centaurea cyanus, C. montana, C. scabiosa* (Hendel, 1927)
157b. **Euribia macrura** Loew. *Onopordon illyricum* (Hendel, 1927)
157c. **Euribia maura** Frauenfeld. *Inula britannica, I. hirta, I. oculus cristi* (Hendel, 1927)
158. **Euribia quadrifasciata** Meigen. *Centaurea cyanus, C. jacea, C. nigra, C. pallescens, C. rhenana, C. scabiosa, C. serotina, Echinops ritro, Cyanchum vincetoxicum* (Hendel, 1927)
158a. **Euribia solstitialis** Linnaeus. *Carduus acanthoides, C. crispus, C. nutans, Carolina vulgaris, Cirsium lanceolatum* (Hendel, 1927)
158b. **Euribia stigma** Loew. *Achillea millefolium, Anthemis arvensis, A. cotula, Chrysanthemum leucanthemum* (Hendel, 1927)
158c. **Euribia stylata** Fabricius. *Cirsium arvense, C. canum, C. lanceolatum* (Hendel, 1927)
159. **Eurosta comma** Wiedemann. *Solidago fistulosa, S. juncea* (Benjamin, 1934), *S. rugosa* (Daecke, 1910)
161, **Eurosta elsa** Daecke. *Solidago juncea* (Daecke, 1910)
162. **Eurosta nicholsoni** Benjamin. *Solidago* sp. (Benjamin, 1934)
163. **Eurosta reticulata** Snow. *Solidago juncea* (?) (Thompson, 1907), *S. sempervirens* (Benjamin, 1934)

164. **Eurosta solidaginis** Fitch, Goldenrod round-gall fly. *Solidago* sp. (Felt, 1918)
165. **Eutreta diana** Doane. *Artemisia tridentata* (Doane, 1899)
166. **Eutreta sparsa** Wiedemann. *Lantana* sp. (Froggatt, 1909), *Solidago juncea* (?) (Thompson, 1907)
167. **Eutretosoma marshalli** Bezzi. *Vernonia steetziana* (Munro, 1926)
168. **Eutretosoma woodi** Bezzi. *Vernonia kraussii* (Munro, 1929), *V. natalensis*, *V. pinifolia* (Munro, 1926)
169. **Gonioglossum Wiedemanni** Meigen. *Brionia alba* (Hendel, 1927), *B. dioica* (Seguy, 1932)
170. **Hexachaeta argiphilae** Costa Lima. *Argiphila cuspidata* (d'Araujo, 1936)
170a. **Hyaloctoides semiatra** Loew. *Justicia pulegioides* (Munro, 1937)
170b. **Hypenidium novaki** Strobl. *Lactuca viminea* (Hendel, 1927)
170c. **Icterica schneideri** Loew. *Inula britannica* (Hendel, 1927)
170d. **Icterica westermanni** Meigen. *Senecio jacobaea* (Hendel, 1927)
171. **Monacrostichus citricola** Bezzi. Wild oranges (Essig, 1913)
172. **Munroella myiopitina** Bezzi. *Lantana salvifolia* (Munro, 1935), *Lippia asperifolia* (Munro, 1925)
173. **Munromyia nudiseta** Bezzi, The olive-seed fruit-fly. *Olea foveolata* (Bezzi, 1924)
174. **Myiolia lucida** Fallen. *Lonicera xylosteum* (Seguy, 1932)
175. **Myiopardalus pardalina** Bigot, The Baluchistan melon fly. *Cucurbita* sp., *Cucumis melo*, Faqus, Melon (Efflatoun, 1924)
175a. **Myiopardalus tenella** Fuessly. *Inula britannica* (Hendel, 1927)
176. **Myoleja limata** Coquillett. *Ilex cassinae*, *I. caroliniana* (Benjamin, 1934), *I. decidua* (Blanton coll.), *I. glabra*, *I. lucida*, *I. opaca*, *I. vomitoria* (Benjamin, 1934)
177. **Myopites blotii** Brebisson. *Inula britannica*, *I. crithmoides*, *I. ensifolia*, *I. hybrida*, *I. salicina*, *I. viscosa* (Seguy, 1932), *Jasonia glutinosa* (Hendel, 1927), *Pulicaria dysenterica* (Seguy, 1932), *P. odora* (Hendel, 1927)
178. **Myopites eximia** Seguy. *Inula crithmoides* (Seguy, 1932)
179. **Myopites frauenfeldi** Schiner. *Inula crithmoides* (Frauenfeld, 1863)
180. **Myopites inulae** von Roser. *Inula ensifolia*, *I. hybrida*, *Pulicaria dysenteria* (Frauenfeld, 1863)
181. **Myopites jasoniae** Dufour. *Jasonia glutinosa* (Dufour, 1862)
182. **Myopites limbardae** Schiner. *Inula viscosa* (Frauenfeld, 1863)
183. **Myopites longirostris** Loew. *Inula crithmoides*, *Pulicaria dysenterica* (Seguy, 1932)
184. **Myopites nigrescens** Becker. *Inula crithmoides* (Seguy, 1932)
185. **Myopites stylata** Fabricius. *Inula viscosa*, *Jasonia glutinosa* (Seguy, 1932)
186. **Myopites tenella** Frauenfeld. *Inula britannica* (Frauenfeld, 1863)
187. **Myopites variofasciata** Becker. *Inula crithmoides* (Efflatoun, 1927)

188. **Neaspilota achilleae** Johnson. *Achillea Millefolium* (Johnson, 1900), *Aster carolinianus, A. concolor, Chrysopsis latifolia, C. microcephala, C. oligantha, Erigeron ramosus, E. vernus, Hieracium argyraeum, H. Grovonii, H. scabrum, Sericocarpus acutisquamosus* (Benjamin, 1934)
189. **Neaspilota alba** Loew. *Vernonia Blodgetti, V. gigantea, V. scaberrima,* (Benjamin, 1934)
190. **Neaspilota albidipennis** Loew. *Vernonia novoboracensis* (Blanton coll.)
191. **Neaspilota dolosa** Benjamin. *Heterotheca subaxillaris* (Benjamin, 1934)
192. **Neaspilota punctistigma** Benjamin. *Chrysopsis hyssopifolia, C. mariana, C. microcephala, C. Traceyi, C. trichophylla, Lantana sellowiana* (?), *Pluchea foetida, P. imbricata, Sericocarpus acutisquamosus, S. bifoliatus* (Benjamin, 1934)
193. **Noeeta pupillata** Fallen. *Andryala sinuata, Hieracium boreale, H. Florentinum* (Seguy, 1932), *H. laevigatum* (Hendel, 1927), *H. murorum* (Seguy, 1932), *H. sabaudum, H. silvestre* (Hendel, 1927), *H. umbellatum, H. vulgatum* (Seguy, 1932)
194. **Ocnerioxa sinuata** Loew. *Combretum erythrophyllum* (?) (Munro, 1925)

Oedaspis atra Loew. See 241. **Procecidochares atra** Loew.

195. **Oedaspis heringi** Hendel. *Schizogyne sericea* (Hendel, 1927)
196. **Oedaspis maraisi** Munro. *Othonna pallens* (Munro, 1935)

Oedaspis polita Loew. See 296. **Procecidochares polita** Loew.

197. **Oedaspis russa** Munro. *Helichrysum cymosum, H. auriculatum* (Munro, 1935)

Oedaspis trotteriana Bezzi. See 246a. **Procecidochares trotteriana** Bezzi.

Oedaspis sp. See 246b. **Procecidochares** sp.

199. **Orellia colon** Meigen. *Centaurea Cyanus, C. maculosa* var. *rhenana, C. scabiosa, Daucus Carota, Jurinea mollis, Picris hieracioides, Tragopogon porrifolius* (Seguy, 1932)
200. **Orellia cylindrica** Robineau-Desvoidy. *Arctium* sp., *Carduus* sp., *Centaurea Jacea, C. pratensis, Cirsium palustre, Jurinea* sp., *Onopordum* sp. (Seguy, 1932)
201. **Orellia falcata** Scopoli. *Tragopogon pratense* (Hendel, 1927)
202. **Orellia jaceae** Robineau-Desvoidy. *Centaurea nigra, C. pratensis, C. Scabiosa, Cirsium lanceolatum* (Seguy, 1932)
203. **Orellia lappae** Hendel. *Carduus acanthoides, Centaurea nigra, Onopordum acanthium* (Seguy, 1932)
204. **Orellia punctata** Schrank. *Tragopogon pratense* (Seguy, 1932)
205. **Orellia ruficauda** Hendel. *Cirsium arvense* (Seguy, 1932), *C. canum* (Hendel, 1927), *C. oleraceum, C. palustre* (Seguy, 1932)
206. **Orellia tussilaginis** Hendel. *Arctium lappae, A. tomentosum, Centaurea jacea* (Hendel, 1927), *C. nigra, C. pratensis* (Seguy, 1932), *Cirsium canum* (Hendel, 1927), *C. eriophorum* (Seguy, 1932), *Jurinea mollis* (Hendel, 1927), *Lappa officinalis* (Seguy, 1932)

207. **Orellia wenigeri** Meigen. *Centaurea Scabiosa* (Seguy, 1932), *Jurinea mollis* (Hendel, 1927)
208. **Orellia winthemi** Meigen. *Carduus acanthoides* (Hendel, 1927), *Cirsium eriophorum, C. palustre* (Seguy, 1932)
208a. **Oxyaciura tibialis** Robineau-Desvoidy. *Lavandula coronopifolia* (Hendel, 1927)
209. **Oxyna flavipennis** Loew. *Achillea Millefolium* (Seguy, 1932)
210. **Oxyna nebulosa** Wiedemann. *Chrysanthemum leucanthemum* (Hendel, 1927), *Leucanthemum corymbosum, L. vulgare* (Seguy, 1932)
211. **Oxyna parietina** Linnaeus. *Artemisia Absinthium, A. campestris, A. vulgaris* (Seguy, 1932)
211a. **Oxyna plantaginis** Halliday. *Plantago maritima* (Frost, 1924)
212. **Oxyphora miliaris** Schrank. *Carduus nutans, Cirsium eriophorum, C. arvense, C. palustre* (Frauenfeld, 1863)
213. **Oxyphora Schaefferi** Frauenfeld. *Centaurea axillaris, C. montana* (Frauenfeld, 1863)
214. **Paracantha culta** Wiedemann. *Cirsium horridulum, C. Nuttallii* (Benjamin, 1934)
215. **Paracantha forficula** Benjamin. *Borrichia frutescens* (Benjamin, 1934)
216. **Parafreutreta bryanti** Munro. Bryant's gall-fly. *Senecio longiflora* (Munro, 1929), *S. angulatus* (Munro, 1935)
217. **Parafreutreta conferta** Bezzi, The Social gall-fly. *Senecio quinquefolia* (Munro, 1926)
217a. **Parasphenella debskii** Efflatoun. *Stachys aegyptiaca* (Hendel, 1927)
217b. **Pardalaspis bipustulata** Bezzi. *Capparis corymbifera* (Munro, 1935)
218. **Pardalaspis cosyra** Walker, The Marula fruit-fly. *Spondias* sp. (Munro, 1929, Ann. S. Afr. Mus., XXIX, p. 4), *Sclerocarya caffra* (Munro, 1925)
218a. **Pardalaspis marriotti** Munro. *Solanum giganteum* (Munro, 1935)
219. **Pardalaspis melanaspis** Bezzi, Boscia fruit-fly. *Boscia caffra* (Munro, 1925), *Maerna pendulosa* (Bezzi, 1924), *Niebuhria triphyllum* (Munro, 1925)
220. **Pardalaspis pedestris** Bezzi, The Strychnos fruit-fly. *Strychnos Gerrardi, S. pungens* (Munro, 1925)
221. **Pardalaspis punctata** Wiedemann. Cocoa pods, Coffee, Guava, Mango, Passion fruit (Munro, 1925)
222. **Pardalaspis quinaria** Bezzi. Apricot (Munro, 1925)
223. **Paroxyna absinthii** Fabricius. *Bidens cernuua, B. tripartitus, Centaurea maculosa* var. *rhenana, Filago gallica, Leucanthemum vulgare, Tagetes erecta* (Seguy, 1932)
224. **Paroxyna achyrophori** Hendel. *Crepis* sp. (Hendel, 1927), *Hieracium murorum, H. villosum, Hypochaeris uniflora* (Seguy, 1932)
224a. **Paroxyna caffra** Loew. *Vernonia hirsuta* (Munro, 1935)
224b. **Paroxyna conyzae** Frauenfeld. *Conyza aegyptiaca* (Hendel, 1927)
225. **Paroxyna doronici** Loew. *Doronicum austriacum* (Seguy, 1932)

226. **Paroxyna Loewiana** Hendel. *Aster amellus, Solidago virgo-aurea* (Seguy, 1932)
227. **Paroxyna misella** Loew. *Lactuca Scariola* (Seguy, 1932)
228. **Paroxyna picciola** Bigot. *Actinospermum angustifolium, Bidens bipinnata, B. laevia, B. leucantha, Coreopsis Leavenworthii, C. nudata, C. tripteris, Cosmos* sp., *Tagetes erecta* (Benjamin, 1934)
229. **Paroxyna plantaginis** Haliday. *Aster Tripolium* (Seguy, 1932)
229a. **Paroxyna praetexta** Loew. *Melanthera brownei* (Munro, 1935)
230. **Paroxyna punctella** Fallen. *Scorzonera Jacquiniana* (Seguy, 1932)
231. **Paroxyna siphonina** Bezzi. *Bidens pilosa* (Munro, 1935)
232. **Paroxyna tesellata** Loew. *Crepis paludosa, C. virens, Hypochaeris radicata, Leontodon autumnalis, L. hispidus, Sonchus arvensis, Taraxicum officinale* (Seguy, 1932)
233. **Paroxyna thomae** Curran. *Bidens bipinnata* (Benjamin, 1934)
233a. **Paroxyna tristrigata** Bezzi. *Melanthera brownei* (Munro, 1935)
234. **Paroxyna maculata** Curran. *Chrysopsis trichophylla* (Benjamin, 1934)

Peronyma maculata Curran. See 234. **Paroxyna maculata** Curran.

234a. **Perirhithrum marshalli** Bezzi. *Barleria obtusa, B. gueinzii* (Munro, 1935)
235. **Phagocarpus permundus** Harris. *Berberis canadensis, B. concinna, B. Jamesiana, B. koreana, B. Lycium, B. morrisonensis, B. orthobotrys, B. rubrostilla, B. sibirica, B. Thunbergii, B. triacanthiphora, B. Vilmorinii, B. yunnanensis, Cotoneaster affinis, C. bullata, C. divaricata, C. frigida, C. tomentosa, Crataegus oxyacanthoides* (Wilson, 1931), *Sorbus Aucuparia* (?) (Seguy, 1932)
236. **Philophylla heraclei** Linnaeus, The Celery fly. *Angelica sylvestris* (Frost, 1924), *Anthriscus cerefolium* (DeVos-DeWilde, 1935), *Apium graveolens* (Frost, 1924), *Archangelica officinalis, Arctium lappa* ? (Hendel, 1927), *Artemisia vulgaris, Carduus* sp. (Frost, 1924), Celery, Celeriac (Chevalier, 1927), *Chrysanthemum* sp. (Frost, 1924), *Cicuta virosa* (DeVos-DeWilde, 1935), *Cirsium arvensis, Cnicus arvensis* (Frost, 1924), *Falcaria Rivini* (Seguy, 1932), *Helianthus tuberosus, Heracleum asperum, H. giganteum, H. longifolium, H. Spondylium, Levisticum officinale, Ligusticum* sp., *Onopordum acanthium, Pastinaca sativa* (Frost, 1924), *P. sylvestris* (Seguy, 1932), *Petroselinum hortense, Rumex aquaticus* (Frost, 1924), *R. hydrolapathum* (DeVos-DeWilde, 1935), *Sium latifolium* (Frost, 1924).

Phorellia peringueyi Bezzi. See 410a. **Trypeta peringueyi** Bezzi.

238. **Phorellia phaeoptera** Bezzi. *Osteospermum moniliferum* (Munro, 1926)

Plagiotoma obliqua Say. See 350. **Tomoplagia obliqua** Say.

239. **Platensina diaphasis** Bigot. *Asystasia coromandeliana* (Munro, 1937)
240. **Platyparea poecilopteria** Schrank. *Asparagus officinale* (Seguy, 1932)
240a. **Pliomelaena brevifrons** Bezzi. *Justicia campylostemon, J. capensis, Rhinacanthus communis* (Munro, 1937)

240b. **Pliomelaena rufiventris** Bezzi. *Hypoestes aristata* (Munro, 1937)
240c. **Polymorphomyia basilica** Snow. *Eupatorium odoratum* (Wolcott, 1924)
241. **Procecidochares atra** Loew. *Bigelowia graveolens* (Felt, 1918), *Chrysothamnus* sp. (Aldrich, 1929), *Solidago altissima* (Felt, 1918), *S. nemoralis* (Aldrich, 1929)
242. **Procecidochares australis** Aldrich. *Erigeron pusillus*, *Heterotheca subaxillaris* (Benjamin, 1934)
243. **Procecidochares grindeliae** Aldrich. *Grindelia robusta* (Aldrich, 1929)
244. **Procecidochares minuta** Snow. *Chrysothamnus graveolens* (Aldrich 1929)
245. **Procecidochares pleuralis** Aldrich. Sunflower (Aldrich, 1929).
246. **Procecidochares polita** Loew. *Solidago altissima* (Felt, 1918)
246a. **Procecidochares trotteriana** Bezzi. *Artemisia campestris*, *A. monospermum* (Efflatoun, 1927)
246b. **Procecidochares** sp. *Artemisia herba-alba* (Seguy, 1932)
247. **Pterandrus anonae** Graham. *Anona* sp., Cocoa pods, Guava (Munro, 1925)
248. **Pterandrus colae** Silvestri. Kola-nut pods (Munro, 1925)
249. **Pterandrus cornutus** Bezzi, The Horned fruit-fly. *Oxyanthus natalensis* (Munro, 1926)
249a. **Pterandrus fasciventris** Bezzi. Loquat (Munro, 1925)
250. **Pterandrus podocarpi** Bezzi, The Yellow-wood fruit-fly. *Podocarpus elongata* (Munro, 1925)
251. **Pterandrus rosa** Karsch., The Natal fruit-fly. Apple, Apricot, Avocado (Munro, 1925), Blackberries (Munro, 1935), *Chrysophyllum natalense*, Custard apple, *Doryalis caffra* (Munro, 1925), *Eugenia cordata* (Munro, 1935), Fig, Guava, Loquat, Mango, Naartje, Nectarine, Orange, Pawpaw, Peach (Munro, 1925), Pear (Munro, 1929), Persimmon, Plum, Quince, Sapodilla, *Solanum giganteum* (Munro, 1925), Spineless cactus (Munro, 1929)
252. **Pterandrus rosa** var. **fasciventris** Bezzi, The Striped Natal fruit-fly. Guava (Bezzi, 1924), Loquat (Munro, 1925)
253. **Pterandrus rubivorus** Coquillett, The Blackberry fruit-fly. Blackberry (Munro, 1935)
253a. **Ptiloedaspis tavaresiana** Bezzi. *Artemisia herba-alba* (Hendel, 1927)
253b. **Rhabdochaeta antineurum** Munro. *Vernonia* sp. (Munro, 1935)
254. **Rhabdochaeta nigra** Bezzi. *Melanthera brounii* (Munro, 1926)
255. **Rhagoletis alternata** Fallen. *Lonicera Xylosteum*, *Rosa rugosa* (Seguy, 1932), *R. villosa* (Hendel, 1927)
256. **Rhagoletis berberis** Curran. *Berberis nervosa* (Curran, 1932)
257. **Rhagoletis boycei** Cresson. *Juglans regia* (Cresson, 1929)
258. **Rhagoletis cerasi** Linnaeus, The Cherry fruit-fly. *Berberis vulgaris* (Seguy, 1932), *Cornus sanguinea* (Mik, 1898), *Lonicera alpigena*, *L. Caprifolium*, *L. coerulea*, *L. diversifolia*, *L. iberica*, *L. Ledebouri*, *L.*

Morrowii, L. orientalis (Thiem, 1934), *L. tatarica, L. Xylosteum, Lycium barbarum* (Seguy, 1932), *Mahonia aquifolium* (Thiem, 1934), *Prunus avium, P. Cerasus* (Hendel, 1927), *P. Mahaleb, P. Padus, Symphoricarpus racemosus, S. orbiculatus, Vaccinium Myrtillus* (Thiem, 1934)

259. **Rhagoletis cingulata** Loew. *Chionanthus virginica* (Benjamin, 1934), *Lonicera* sp. (Slingerland, 1899), *Osmanthus americana, Prunus serotina* (Benjamin, 1934)
260. **Rhagoletis completa** Cresson. Persian walnut (Boyce, 1929)
261. **Rhagoletis fausta** Osten Sacken. Cultivated cherry, *Prunus pennsylvanica* (Severin, 1918)
262. **Rhagoletis grindeliae** Coquillett. *Grindelia squarrosa* var. *nuda* (Coquillett, 1907)
263. **Rhagoletis indifferens** Curran. *Prunus marginata* (Curran, 1932)
264. **Rhagoletis juglandis** Cresson, The Black-walnut fly. *Juglans Hindsii, J. regia, J. rupestris* (Boyce, 1929)
265. **Rhagoletis juniperinus** Marcovitch, The Juniper berry fruit-fly. *Juniperus virginiana* (Marcovitch, 1915)
266. **Rhagoletis Meigeni** Loew. *Berberis vulgaris* (Seguy, 1932)
267. **Rhagoletis mendax** Curran, The Blueberry maggot. *Amelanchier Bartramiana, Aronia melanocarpa, Cornus canadensis, Gaultheria procumbens, Gaylussacia baccata, Vaccinium angustifolium, V. canadense, V. corymbosum, V. pennsylvanicum, V. vacillans, V. Vitis-idaea minus* (Lathrop & Nichels, 1932)
268. **Rhagoletis pomonella** Walsh, The Apple maggot. *Aronia arbutifolia, Cornus florida* (Benjamin, 1934), Crab apple (Froggatt, 1909), Cranberry (Greene, 1929), *Crataegus* (Froggatt, 1909), Plum (Lathrop & Nichels, 1932), *Prunus angustifolia* (Benjamin, 1934), *P. Persica* (Lathrop & Nichels, 1932), *P. umbellata* (Benjamin, 1934), *Pyrus communis* (Lathrop & Nichels, 1932), *Pyrus Malus* (Illingworth, 1912)
269. **Rhagoletis ribicola** Doane, The Black currant-fly. *Ribes aureum* (Jones coll.), *Ribes Grossularia, R. vulgare* (Piper & Doane, 1898)
270. **Rhagoletis suavis** Loew, The Walnut husk-maggot. Black walnut, Butternut, English walnut, Japanese walnut (Gambrell, 1931)
271. **Rhagoletis symphoricarpi** Curran, The Snowberry maggot. Snowberry (Lathrop & Nichels, 1932)
272. **Rhagoletis tabellaria** Walsh. Blueberry (Lathrop & Nichels, 1932), Western tall blueberry (Plank, 1923), Whortleberry (Lathrop & Nichels, 1932)
273. **Rhagoletis zephyria** Curran. *Batodendron arboreum* (Benjamin, 1934), Blueberries, Whortleberry (Lathrop & Nichels, 1932)

273a. **Rhochmopterum arcoides** Munro. *Vernonia kraussii* (Munro, 1935)

274. **Rhochmopterum munroi** Bezzi. *Vernonia hirsuta, V. kraussii, V. lasioclada* (Munro, 1935), *V. monocephala* (Munro, 1929), *V. natalensis, V. pinifolia* (Munro, 1926), *V. steetziana* (Munro, 1929)

274a. **Rhochmopterum munroi** var. **major** Bezzi. *Vernonia fastigiata, V. natalensis, V. pinifolia* (Munro, 1926)

274b. **Rhochmopterum pygmaeum** Munro. *Vernonia hirsuta, V. pinifolia, V. kraussii, V. anisochaetoides* (Munro, 1935)

275. **Rioxa musae** Froggatt, The Island fruit-fly. Banana, *Sideroxylon australe* (Pierce, 1917)

276. **Schistopterum moebiusi** Becker. *Pluchea dioscorides* (Efflatoun, 1927)

Spathulina acroleuca var. **parceguttata** Becker. See 278. **Spathulina parceguttata** Becker.

277. **Spathulina biseuarestina** Bezzi. *Athrixia elata* (Munro, 1925)

277a. **Spathulina hessii** Wiedemann. *Helichrysum vestitum* (Munro, 1935)

278. **Spathulina parceguttata** Becker. *Ceruana pratensis, Helichrysum* sp. (Efflatoun, 1927), *Matricaria aurea* (Hendel, 1927)

279. **Spathulina parceguttata** var. **parca** Bezzi. *Helichrysum* sp. (Bezzi, 1924)

280. **Spathulina peringueyi** Bezzi. *Elytropappus rhinocerotis* (Munro, 1935)

281. **Spathulina tristis** Loew. *Phagnalon rupestre, P. saxatile* (Seguy, 1932)

281a. **Sphenella helianthoides** Bezzi. *Senecio latifolius* (Munro, 1935)

282. **Sphenella marginata** Fallen. Senecio nest flower-fly. *Centaurea rhenana* (DeVos-DeWilde, 1935), *Cineraria* sp., *Picris sprengeriana* (Efflatoun, 1927), *Senecio aquaticus* (Seguy, 1932), *S. concolor* (Munro, 1926), *S. coronopifolius, S. crispatus* (DeVos-DeWilde, 1935), *S. diodon* (Munro, 1925), *S. jacobaea* (Seguy, 1932), *S. paludosus* (DeVos-DeWilde, 1935), *S. ruderalis* (Munro, 1925), *S. silvaticus* (Seguy, 1932), *S. speciosa* (Munro, 1935), *S. vernalis, S. viscosus* (DeVos-DeWilde, 1935), *S. vulgaris* (Seguy, 1932)

283. **Sphenella melanostigma** Bezzi. *Senecio latifolius* (Munro, 1935)

Sphenella nigricornis Bezzi. See 283. **Sphenella melanostigma** Bezzi.

283a. **Sphenella semisphenella** Bezzi. *Senecio lasiorhyzus* (Munro, 1935)

284. **Spheniscomyia aegyptiaca** Efflatoun. *Lavandula coronopifolia, Stachys aegyptiaca* ? (Efflatoun, 1924)

285. **Spheniscomyia binaria** Loew. *Lippia asperifolia* (Munro, 1925)

286. **Spheniscomyia debskii** Efflatoun. *Stachys aegyptiaca* (Efflatoun, 1927)

287. **Spheniscomyia filiola** Loew. *Lavandula coronopifolia* (Efflatoun, 1927)

288. **Spheniscomyia quartenaria** Bezzi. *Lantana salvifolia* (Munro, 1935), *Lippia asperifolia* (Munro, 1925), *L. scaberrima* (Munro, 1929)

289. **Spheniscomyia quinaria** Bezzi. *Lantana salvifolia, Lippia asperifolia* (Munro, 1935)

290. **Spheniscomyia sexmaculata** Macquart. *Becium obovatum* (Munro, 1929), *Plectranthus* sp. (Munro, 1926), *Salvia radula, S. rugosa* (Munro, 1929)

291. **Spilographa abrotani** Meigen. *Adenostyles alpina, Eupatorium cannabium* (Mik, 1888)

Spilographa alternata Fallen. See 396. **Trypeta alternata** Fallen.

Spilographa artemisiae. See 397. **Trypeta artemisiae** Fabricius.

292. **Spilographa zoe** Loew. *Arctium majus, A. minus, Chrysanthemum leucanthemum, C. Parthenium, Eupatorium cannabinum, Senecio aquatica, S. erucifolia, S. vulgaris* (Frost, 1924)

292a. **Stenotrypeta marriotti** Munro. *Polemannia grossulariifolia* (Munro, 1935)

292b. **Stenotrypeta vivax** Munro. *Senecio pterophorus, S. paniculatus* (Munro, 1935)

293. **Straussia longipennis** Wiedemann, The Sunflower maggot. *Helianthus hirsutus* (Marcovitch, 1916), Jerusalem artichoke (Slingerland's specimens in Cornell collection), Sunflower (Britton, 1931)

294. **Tephritis absinthii** Fabricius. *Artemisia maritima* (Pearce, 1928), *Bidens cernua* (Boie, 1847), *Podospermum Jacquiniana* (Frauenfeld, 1863)

295. **Tephritis amoena** Frauenfeld. *Asteriscus graveolens, Centaurea calcitrapa, Lactuca saligna, L. Scariola, L. virosa, Picris hieracioides, P. sprengeriana, Sonchus oleraceus, Zygophyllum coccineum* ? (Efflatoun, 1924)

296. **Tephritis angustipennis** Loew. *Achillea Ptarmica* (Seguy, 1932)

297. **Tephritis arctii** DeGeer. *Arctium Lappa, Leontodon Taraxacum* (Curtis, 1828)

298. **Tephritis argyrocephala** Loew. *Aster Amellus, Solidago virgo-aurea* (Efflatoun, 1924)

299. **Tephritis arnica** Linnaeus. *Arnica montana* (Seguy, 1932), *Aster bellidiastrum* (Hendel, 1927), *Bellidiastrum Michelii, Doronicum austriacum* (Seguy, 1932)

300. **Tephritis baccharis** Coquillett. *Baccharis viminea* (Coquillett, 1894)

301. **Tephritis bardanae** Schrank. *Arctium lappa, A. minus, A. tomentosum* (Hendel, 1927), Burdock (Pearce, 1928), *Lappa major, L. minor, L. officinalis, L. tomentosa* (Seguy, 1932)

302. **Tephritis cardui** Linnaeus. *Serratula arvensis* (Curtis, 1828)

303. **Tephritis conjuncta** Loew. *Leontodon autumnalis* (Frauenfeld, 1863)

304. **Tephritis conura** Loew. *Cirsium erisithales, C. heterophyllum, C. oleraceum* (Hendel, 1927), *C. palustre* (Seguy, 1932), *Jurinea mollis* ? (Hendel, 1927)

305. **Tephritis conyza** Frauenfeld. *Conyza aegyptiaca* ? (Efflatoun, 1924)

306. **Tephritis cornuta** Fabricius. *Centaurea scabiosa* (Boie, 1847), *Scabiosa succisa* (Curtis, 1828)

306a. **Tephitris crepidis** Hendel. *Crepis chondrilloides, C. blattarioides, C. biennis* (Hendel, 1927)

307. **Tephritis desertorum** Efflatoun. *Launea spinosa* (Efflatoun, 1927)

308. **Tephritis dilacerata** Loew. *Sonchus arvensis* (Seguy, 1932), *S. oleraceus* (Frauenfeld, 1863)

309. **Tephritis dioscurea** Loew. *Achillea millefolium, Artemisia crithmifolia,* (Seguy, 1932), *Crepis* sp. (Frauenfeld, 1863), *Leucanthemum corymbosum* (Seguy, 1932)

310. **Tephritis doronici** Loew. *Crepis biennis, C. virens, Doronicum pardalianches, Hieracium villosum* (Frauenfeld, 1863)
311. **Tephritis Eggeri** Frauenfeld. *Doronicum pardalianches* (Frauenfeld, 1863)
312. **Tephritis elongulata** Loew. *Bidens cernua, Centaurea paniculata, Tagetes erecta* (Frauenfeld, 1863)
313. **Tephritis eluta** Meigen. *Amberboa Lippi, Centaurea Jacea, C. paniculata, Onopordon illyricum* (Frauenfeld, 1863)
314. **Tephritis fallax** Loew. *Crepis* sp. (Hendel, 1927)
315. **Tephritis finalis** Loew. Dahlia (Bissell, 1936)
316. **Tephritis formosa** Loew. *Crepis virens, Hypochaeris radicata, Sonchus oleraceus* (Seguy, 1932)
317. **Tephritis Frauenfeldi** Hendel. *Jurinea mollis* (Seguy, 1932)
318. **Tephritis Heiseri** Frauenfeld. *Carduus defloratus, C. nutans* (Seguy, 1932)
319. **Tephritis hyoscyami** Linnaeus. *Carduus crispus, C. nutans, C. personatus* (Seguy, 1932)
319a. **Tephritis jasoniae** Dufour. *Jasonia glutinosa* (Dufour, 1862)
320. **Tephritis leontodontis** DeGeer. *Arnica montana, Chrysanthemum leucanthemum* (Hendel, 1927), *Crepis blattarioides, Hieracium chondrilloides, Jurinea mollis, Leontodon autumnalis* (Frauenfeld, 1863), *L. hispidus, Taraxacum officinale* ? (Seguy, 1932)
321. **Tephritis mamulae** Frauenfeld. *Gnaphalium angustifolium* (Frauenfeld, 1863)
322. **Tephritis marginata** Fallen. *Centaurea paniculata, Cineraria crispa, Senecio Jacobaea, S. paludosus, S. vernalis* (Frauenfeld, 1863), *Tanacetum* sp. (Curtis, 1828)
323. **Tephritis matricariae** Loew. *Anthemis melampodia* (Efflatoun, 1924), *Crepis virens* (Seguy, 1932)
324. **Tephritis mundelli** Costa Lima. *Xanthium Cavanillesii* (Costa Lima, 1936)
325. **Tephritis murina** Doane. *Aster foliaceus* (Wilson, 1931)
326. **Tephritis nesii** Wiedemann. *Chrysanthemum leucanthemum* (Hendel, 1927), *Crepis virens, Leontodon autumnalis, Picris hieracioides* (Seguy, 1932)
327. **Tephritis nigricauda** Loew. *Achillea Millefolium, A. Ptarmica* (Seguy, 1932), *Chrysanthemum inodorum* (Frauenfeld, 1863), *Matricaris inodora* (Seguy, 1932)
328. **Tephritis pantherina** Fabricius. *Artemisia vulgaris* (Frauenfeld, 1863)
328a. **Tephritis planiscutellata** Becker. *Pluchea dioscoridis* (Hendel, 1927)
329. **Tephritis plantaginis** Haliday. *Aster tripolium* (Pearce, 1928)
330. **Tephritis postica** Loew. *Onopordum Acanthium* (Seguy, 1932)
331. **Tephritis praecox** Loew. *Filago gallica* (Hendel, 1927)

332. **Tephritis producta** Loew. *Leontodon autumnalis, L. hastile* (Frauenfeld, 1863)
333. **Tephritis psidii** Froggatt. Guava (French, 1907)
334. **Tephritis pulcherrima** Efflatoun. *Launea nudicaulis* (Efflatoun, 1927)
335. **Tephritis pulchra** Loew. *Podospermum Jacquin* (Frauenfeld, 1863), *Scorzonera hispanica, S. humilis* (Seguy, 1932), *S. jaquiniana* (Hendel, 1927)
336. **Tephritis radiata** Fabricius. *Tragopogon pratense* (Curtis, 1828)
337. **Tephritis ruralis** Loew. *Crepis* sp., *Hieracium Pilosella* (Frauenfeld, 1863)
338. **Tephritis solstitialis** Linnaeus. Thistle (Curtis, 1828)
339. **Tephritis stictica** Loew. *Diotis canditissima* (Hendel, 1927), *D. maritima* (Seguy, 1932)
340. **Tephritis stylata** Fabricius. Thistle (Curtis, 1828)
341. **Tephritis tessellata** Loew. *Sonchus arvensis, Taraxacum officinale,* (Efflatoun, 1924)
342. **Tephritis truncata** Loew. *Hieracium murorum, Leontodon incanus* (Frauenfeld, 1863)
343. **Tephritis vespertina** Loew. *Hypochaeris radicata, Tragopogon pratensis* (Seguy, 1932)
344. **Terellia jaceae** Robineau-Desvoidy. *Centaurea calcitrapa, C. pallescens, C. Scabiosa* (Efflatoun, 1924)
345. **Terellia longicauda** Meigen. *Carduus defloratus, Cirsium eriophorum* (Seguy, 1932)
346. **Terellia planiscutellata** Becker. *Pluchea dioscorides* (Efflatoun, 1927)
347. **Terellia serratulae** Linnaeus. *Carduus acanthoides, C. defloratus* (Efflatoun, 1924), *C. nutans, Cirsium lanceolatum* (Seguy, 1932)
348. **Terellia virens** Loew. *Centaurea maculosa* var. *Rhenana* (Seguy, 1932), *C. paniculata* (Efflatoun, 1924)

348a. **Tetradacus tsuneonis** Miyake. *Citrus* sp. (Hendel, 1927)

349. **Themarictera laticeps** Loew, Boscia broad-head fruit-fly. *Boscia caffra* (Munro, 1925)
350. **Tomoplagia obliqua** Say. *Vernonia Blodgetti, V. gigantea, V. scaberrima* (Benjamin, 1934)
351. **Tomoplagia rudolphi** Lutz & Costa Lima. *Vernonia* sp. (d'Araujo, 1936)
352. **Toxotrypana curvicauda** Gerstaecker, The Papaya fruit-fly. *Carica papaya* (Greene, 1929)
353. **Tridacus bivittatus** Bigot, Large two-spotted pumpkin-fly. *Coccinea palmata,* Pumpkin (Munro, 1925)
354. **Tridacus lounsburyi** Coquillett, Great pumpkin-fly. Pumpkin, Spaanspek, Vegetable marrow, Watermelon (Munro, 1925)
355. **Tridacus mallyi** Bezzi, Lesser two-spotted pumpkin-fly. *Cucumis africana* (Munro, 1925)

356. **Tridacus momordicae** Bezzi. *Cucurbita* sp. (Munro, 1925)
357. **Tridacus pectoralis** Walker, Pectoral pumpkin-fly. Calabash (Munro, 1926), *Momordica involucrata*, Pawpaw, Pumpkin, Spaanspek (Munro, 1925), Tomato (Munro, 1926), Watermelon (Munro, 1925)
359. **Tridacus punctatifrons** Karsch. Punctate pumpkin-fly. Pumpkin (Munro, 1925)
359a. **Trirhithromyia lycii** Coquillett. *Lycium campanulatum* (Munro, 1935)
360. **Trirhithrum albomaculatum** von Roeder. Kei-apple fruit-fly. *Doryalis caffra, D. rotundifolia* (Munro, 1925)
361. **Trirhithrum lycii** Coquillett, Lycium fruit-fly. *Lycium campanulatum* (Munro, 1929)
362. **Trirhithrum nigerrimum** Bezzi. *Cissus cirrhosa* (Munro, 1935), Coffee (Munro, 1925), *Eugenia uniflora* (Munro, 1935)
363. **Trirhithrum nigrum** Graham. Cocoa pods (Munro, 1925)
364. **Trirhithrum occipitale** Bezzi, Wild-grape fruit-fly. *Cissus cirrhosa* (Munro, 1925)
365. **Trupanea abstersa** Loew. *Trilisa paniculata* (Benjamin, 1934)
366. **Trupanea actinibola** Loew. *Actinospermum angustifolium, Aster adnatus, A. carolinianus, Coreopsis* sp., *Erigeron quercifolius, E. vernus* (Benjamin, 1934), *E. sondbergiana* (Blanton collector), *Hieracium* sp., *Solidago* sp. (Benjamin, 1934)
367. **Trupanea ageratae** Benjamin. *Ageratum littorale* (Benjamin, 1934)
368. **Trupanea albicans** Munro. *Brachylaena discolor* (Munro, 1935)
369. **Trupanea amoena** Frauenfeld. *Asteriscus graveolens, Centaurea Calcitrapa, Lactuca saligna* (Efflatoun, 1924), *L. sativa, L. Scariola, L. virosa, Picris hieracinoides, P. Sprengeriana* (Seguy, 1932), *Pluchea indica* (Fulmek, 1927), *Senecio coronopifolius, Sonchus oleraceus* (Seguy, 1932)
369a. **Trupanea arrhiza** Bezzi. *Vernonia monocephala* (Munro, 1935)
370. **Trupanea augur** Frauenfeld. *Asteriscus graveolens* (Efflatoun 1927), *Odontospermum sericeum* (Hendel, 1927), *Pulicaria crispa* (Efflatoun, 1927)
371, **Trupanea auguralis** Bezzi. *Nidorella mespilifolia* (Munro, 1926)
372. **Trupanea aurea** Bezzi. *Vernonia Kraussii* (Munro, 1926), *V. Lasioclada* (Munro, 1929), *V. natalensis* (Munro, 1926), *V. pinifolia* (Munro, 1935)
373. **Trupanea bisreducta** Bezzi. *Berkheya latifolia* (Munro, 1935), *B. stoeboides* (Munro, 1929)
375. **Trupanea confluens** Wiedemann. *Erigeron linifolius* (Munro, 1926), *Gnaphalium undulatum* (Munro, 1929), *Helichrysum foetidum, H. nudifolium* var. *quinquenerve* (Munro, 1935), *H. odoratissimum, H. setosum* (Munro, 1926)
376. **Trupanea dacetoptera** Phillips. *Chrysopsis microcephala, Gnaphalium obtusifolium* (Benjamin, 1934)

377. **Trupanea decora** Loew. *Senecio Diodon* (Munro, 1925), *S. erubescens* (Munro, 1929), *S. inaequidens* (Munro, 1926), *S. ruderalis* (Munro, 1925)
378. **Trupanea dentiens** Bezzi, Athrixia flower-fly. *Athrixia elata* (Munro, 1925)
379. **Trupanea dicomala** Munro. *Dicoma anomala*, *D. anomala* var. *sonderi* (Munro, 1935)
380. **Trupanea eclipta** Benjamin. *Eclipta alba* (Benjamin, 1934)
381. **Trupanea eluta** Meigen. *Centaurea Jacea*, *C. pallescens*, *C. paniculata*, *Onopordon illyricum*, *Silybum Marianum* (Efflatoun, 1924)
381a. **Trupanea furcifera** Bezzi. *Laggera pterodonta*, *L. alata* (Munro, 1935)
382. **Trupanea goliath** Bezzi. *Dicoma speciosa*, *D. zepheri* (Munro, 1935)
383. **Trupanea goliath** var. **Kloofensis** Munro. *Dicoma speciosa* (Munro, 1935)
384. **Trupanea haemorrhoa** Bezzi. *Dicoma zepheri* (Munro, 1926)
385. **Trupanea jonesi** Curran. *Gaertneria* sp. (Curran 1932), *Aster Douglassi*, (Jones coll.)
386. **Trupanea lignoptera** Munro. *Berkheya* sp. (Munro, 1935)
387. **Trupanea mevarna** Walker. *Chrysopsis graminifolia*, *C. latifolia*, *C. microcephala* ?, *C. oligantha* (Benjamin, 1934)
387a. **Trupanea pacifica** Doane. *Senecio Douglasii*(Ballou, 1925)
388. **Trupanea pentziana** Munro. *Pentziana incana* (Munro, 1933)
389. **Trupanea peregrina** Adams. *Helichrysum fulgidum* (Munro, 1929), *H. setosum* (Munro, 1926)
391. **Trupanea stellata** Fuessly. *Anthemis arvensis*, *A. cinerea*, *A. Cotula*, *A. melampodia* (Efflatoun, 1924), *Artemisia Absinthium*, *Aster Tripolium* (Seguy, 1932), *Chrysanthemum Chamomilla* (Frauenfeld, 1863), *C. coronarium* (Efflatoun, 1927), *C. inodorum* (Frauenfeld, 1863), *Coreopsis grandiflora*, *Crepis paludosa* (Hendel, 1927), *Hieracium sabaudum* (Seguy, 1932), *H. silvestre* (Hendel, 1927), *Inula britanica* (Seguy, 1932), *Matricaria chamomilla*, *M. inodora*, *Picridium vulgare* (Efflatoun, 1924), *Reichhardia picroides* (Hendel, 1927), *Senecio jacobaea*, *S. paludosum* (Efflatoun, 1924), *S. vulgaris* (Hendel, 1927), *Serratula tinctoria* (Efflatoun, 1924)
392. **Trupanea subpura** Johnson. *Baccharis glomeruliflora* (Benjamin, 1934)
393. **Trupanea superdecora** Bezzi, Blackjack flower-fly. *Bidens pilosa* (Munro, 1925)
393a. **Trupanea woodi** Bezzi. *Vernonia fastigiata*, *V. steetziana* (Munro, 1926)
394. **Trupanea woodi** var. **arrhiza** Bezzi. *Vernonia kraussii*, *V. lasioclada* (Munro, 1929), *V. natalensis* (Munro, 1925)

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395. **Trypeta acuticornis** Loew. *Carduus defloratus*, *Cirsium eriphorum* (Frauenfeld, 1863)
396. **Trypeta alternata** Fallen. *Lonicera xylosteum*, *Phormium Colensoi*, *Rosa calocarpa*, *R. nutkana*, *R. pomifera*, *R. rugosa* (Wilson, 1931)

397. **Trypeta artemisiae** Fabricius. *Artemisia absinthium, A. discolor, A. dracunculoides, A. gnaphaloides, A. selengensis, A. vulgaris* (Frost, 1924), *Chrysanthemum indicum* (DeVos-DeWilde, 1935), *C. lacustre, C. leucanthemum, C. parthenifolium, C. parthenium* (Frost, 1924), *C. vulgare* (Hendel, 1927), *Eupatorium cannabinum, Leucanthemum vulgare, L. indicum, L. parthenium, Senecio vulgaris, Tanacetum vulgare* (Seguy, 1932)
398. **Trypeta baccharis** Coquillett. *Baccharis viminea* (Coquillett, 1894)
399. **Trypeta colon** Meigen. *Centaurea scabiosa* (Frauenfeld, 1863)
400. **Trypeta continua** Meigen. *Rosa villosa* (Bouché, 1834)
401. **Trypeta florescentiae** Linnaeus. *Cirsium arvense* (Detmers, 1927)
402. **Trypeta intermedia** Frauenfeld. *Tragopogon pratensis* (Frauenfeld, 1863)
403. **Trypeta jacea** Robineau-Desvoidy. *Centaurea scabiosa* (Frauenfeld, 1863)
404. **Trypeta lappae** Cederhielm. *Carduus acanthoides, Onopordon acanthium* (Frauenfeld, 1863)
404a. **Trypeta lemei** Kieffer. *Centaurea jacea* (Hendel, 1927).
405. **Trypeta musae** Froggatt, The Island fruit-fly. *Achris australe* (Froggatt, 1909), Apple, Quince, *Sideroxylon australe* (Gurney, 1912)
406. **Trypeta notata** Coquillett. *Bigelovia graveolens* (Cockerell, 1900)
407. **Trypeta occidentalis** Doane. *Cirsium drummondii* (Gibson, 1915)
408. **Trypeta onotrophes** Loew. *Centaurea cyanus, C. jacea, C. montana, C. phrygia, C. scabiosa, Cirsium canum, C. eriophorum, C. oleraceum, Carduus acanthoides, C. crispus, Jurinea mollis, Lappa tomentosa* (Frauenfeld, 1863)
410. **Trypeta palposa** Loew. *Cnicus pumilus* (Blanton collector)
410a. **Trypeta peringueyi** Bezzi, The Ball-maggot flower-fly. *Senecio erubescens* (Munro, 1935), *S. ruderalis* (Munro, 1925).
410b. **Trypeta ruficauda** Fabricius. *Cirsium canum, C. oleraceum* (Frauenfeld, 1863)
411. **Trypeta serratulae** Linnaeus. *Carduus acanthoides, C. defloratus* (Frauenfeld, 1863)
412. **Trypeta tussilanginis** Frauenfeld. *Centaurea jaceae, Cirsium canum, C. eriophorum, Jurinea mollis, Lappa major, L. tomentosa* (Frauenfeld, 1863)
413. **Trypeta virens** Loew. *Centaurea paniculata* (Frauenfeld, 1863)
414. **Trypeta winthemi** Macquart. *Carduus acanthoides, C. defloratus* (Frauenfeld, 1863)
415. **Trypeta zoë** Meigen. *Adenostyles alpina, Arctium lappa* ? (Hendel, 1927), *Artemisia vulgaris* (Seguy, 1932), *Chrysanthemum leucanthemum, C. parthenium* (Hendel, 1927), *Eupatorium cannabinum, Helianthus tuberosus* (Seguy, 1932), *Lappa* sp. (DeVos-DeWilde, 1935), *Petasites*

albus, *Senecio campestris* (Seguy, 1932), *S. cordatus* (DeVos-DeWilde, 1935), *S. erucifolius*, *S. Fuschi*, *S. Jacobaea* (Seguy, 1932), *S. nemorensis* (DeVos-DeWilde, 1935), *S. vulgaris* (Seguy, 1932)

415a. **Urelliosoma pulcherrima** Efflatoun. *Astericus graveolens* (Hendel, 1927)

416. **Urophora affinis** Frauenfeld. *Carduus nutans*, *Centaurea maculosa* var. *rhenana*, *C. paniculata*, *Microlonchus salmanticus* (Seguy, 1932)

416a. **Urophora agromyzella** Bezzi. *Vernonia amygdalina* (Munro, 1935)

417. **Urophora algira** Macquart. *Centaurea sempervirens* (Seguy, 1932)

418. **Urophora cardui** Linnaeus. *Artemisia* sp., *Cirsium arvense*, *C. lanceolatum*, *C. oleraceum* (Seguy, 1932), *Cnicus arvensis* (Hamm, 1918)

419. **Urophora congrua** Loew. *Cirsium erisitales* (Seguy, 1932)

420. **Urophora cuspidata** Megein. *Centaurea amara*, *C. calcitrapa*, *C. jacea*, *C. montana*, *C. nigra*, *C. scabiosa*, *C. sempervirens* (Seguy, 1932)

421. **Urophora eriolepida** Loew. *Carduus defloratus*, *C. nutans*, *Centaurea cyanus*, *C. montana*, *C. scabiosa*, *Cirsium eriophorum* (Seguy, 1932)

422. **Urophora macrura** Loew. *Centaurea calcitrapa*, *Onopordon illyricum* (Efflatoun, 1924).

423. **Urophora maura** Frauenfeld. *Inula britannica*, *I. hirta*, *I. montana*, *I. oculus cristi* (Seguy, 1932)

424. **Urophora pantomelas** Bezzi. *Helichrysum foetidum* (Munro, 1935), *H. setosum* (Munro, 1926)

425. **Urophora petiolata** var. **seminigra** Munro. *Pentzia incana* (Munro, Ent. Res. XXII, p. 118)

426. **Urophora quadrifasciata** Meigen. *Centaurea cyanus*, *C. jacea*, *C. maculosa* var. *rhenana*, *C. nigra* (Seguy, 1932), *C. pallescens*, *C. paniculata* (Efflatoun, 1924), *Echinops ritro* (Seguy, 1932)

427. **Urophora solstitialis** Linnaeus. *Carduus acanthoides*, *C. crispus*, *C. nutans*, *Carlina vulgaris*, *Centaurea jacea* (Seguy, 1932), *C. montana*, *C. scabiosa*, *Cirsium lanceolatum* (Frauenfeld, 1863)

428. **Urophora stigma** Loew. *Achillea millefolium*, *Anthemis arvensis*, *A. cotula*, *Leucanthemum vulgare* (Seguy, 1932)

429. **Urophora stylata** Fabricius. *Cirsium arvense*, *C. canum*, *C. lanceolatum* (Seguy, 1932), *Onopordum acanthium* (Pearce, 1928)

430. **Vidalia cornuta** Scopoli. *Eupatorium cannabinum*, *Senecio Fuschi*, *S. nemorensis* (Seguy, 1932)

431. **Xanthaciura connexionis** Benjamin. *Ageratum littorale*, *Eupatorium coelestinum* (Benjamin, 1934)

432. **Xanthaciura insecta** Loew. *Bidens leucantha* (Benjamin, 1934)

433. **Xanthaciura tetraspina** Phillips. *Ageratum houstonianum*, *Eupatorium coelestinum* (Benjamin, 1934)

434. **Xyphosia biflexa** Loew. *Inula britannica* (Seguy, 1932)

435. **Xyphosia laticauda** Meigen. *Centaurea nigra*, *C. montana* (Seguy, 1932)

436. **Xyphosia miliaria** Schrank. *Carduus nutans*, *Cirsium arvense*, *C. eriophorum*, *C. palustre* (Seguy, 1932)

437. **Xyphosia westermanni** Meigen. *Senecio Jacobaea* (Seguy, 1932)
438. **Zacerata asparagi** Coquillett, The Asparagus fruit-fly. Asparagus (Munro, 1925)
439. **Zonosema meigenii** Loew. *Berberis vulgaris* (Mik, 1888)
440. **Zonosemata electa** Say. *Capsicum annuum, Lycopersicum esculentum, Solanum aculeatissimum, S. carolinense, S. melongena* (Benjamin, 1934)
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442. **Zonosemata vittigera** Coquillett. *Solanum elaeagnifolium* (Benjamin, 1934)

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Cephalo-pharyngeal skeleton

Fig. 1. *Acidia fratria* (Loew)
Fig. 2. *Anastrepha ludens* (Loew)
Fig. 3. *Anastrepha pallens* Coquillett
Fig. 4. *Anastrepha serpentina* (Wiedemann)
Fig. 5. *Bactrocera cucurbitae* (Coquillett)
Fig. 6. *Ceratitis capitata* (Wiedemann)
Fig. 7. *Dacus ferrugineus* (Fabricius)
Fig. 8. *Dacus oleae* (Rossi)
Fig. 9. *Paroxyna picciola* (Bigot)
Fig. 10. *Epochra canadensis* (Loew)

Cephalo-pharyngeal skeleton

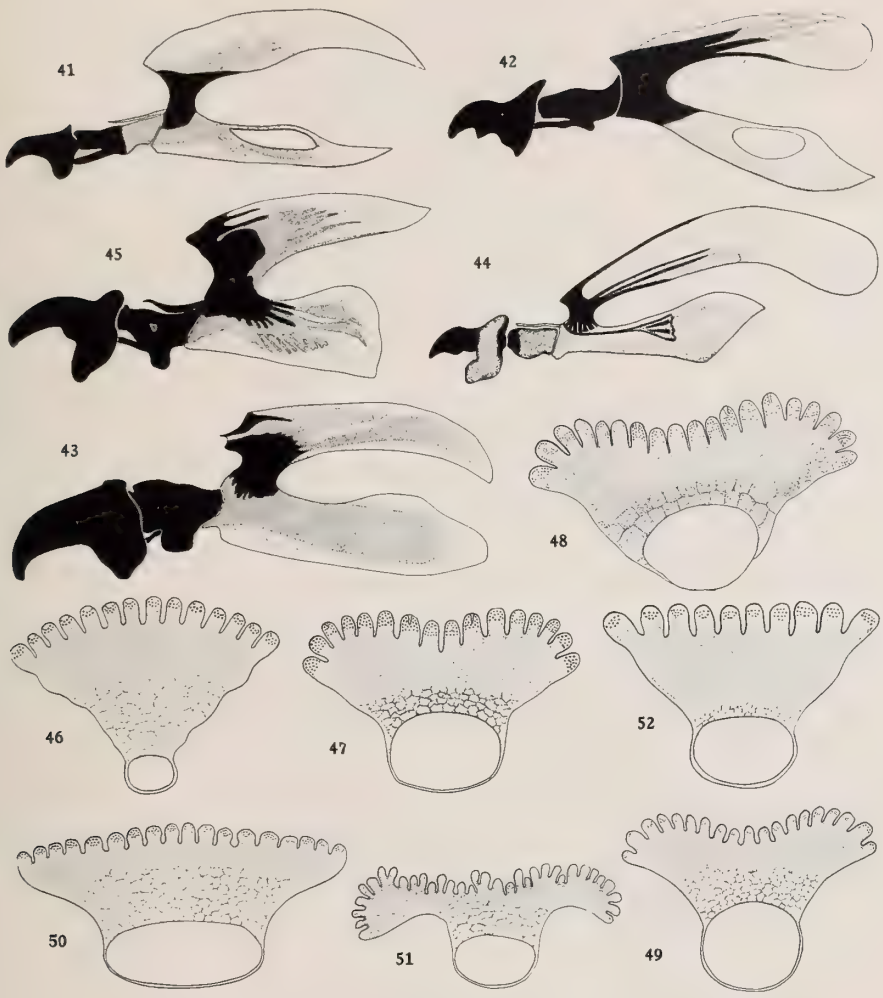
Fig. 11. *Euaresta aequalis* (Loew)
Fig. 12. *Eurosta comma* (Wiedemann)
Fig. 13. *Eurosta solidaginis* (Fitch)
Fig. 14. *Myoleja limata* (Coquillett)
Fig. 15. *Neaspilota achilleae* Johnson
Fig. 16. *Neaspilota albidipennis* (Loew)
Fig. 17. *Paracantha culta* (Wiedemann)
Fig. 18. *Procecidochares atra* (Loew)
Fig. 19. *Procecidochares australis* Aldrich
Fig. 20. *Rhagoletis berberis* Curran

Cephalo-pharyngeal skeleton

Fig. 21. *Rhagoletis cerasi* (Linnaeus)
Fig. 22. *Rhagoletis cingulata* (Loew)
Fig. 23. *Rhagoletis fausta* (Osten Sacken)
Fig. 24. *Rhagoletis indifferens* Curran
Fig. 25. *Rhagoletis juglandis* Cresson
Fig. 26. *Rhagoletis juniperinus* Marcovitch
Fig. 27. *Rhagoletis mendax* Curran
Fig. 28. *Rhagoletis pomonella* (Walsh)
Fig. 29. *Rhagoletis ribicola* Doane
Fig. 30. *Rhagoletis suavis* (Loew)

Cephalo-pharyngeal skeleton

Fig. 31. *Rhagoletis completa* Cresson
Fig. 32. *Rhagoletis symphoricarpi* Curran
Fig. 33. *Straussia longipennis* (Wiedemann)
Fig. 34. *Tephritis finalis* (Loew)
Fig. 35. *Toxotrypana curvicauda* (Gerstaecker)
Fig. 36. *Trupanea abstersa* (Loew)
Fig. 37. *Trupanea actinobola* (Loew)
Fig. 38. *Trupanea jonesi* Curran
Fig. 39. *Trupanea subpura* (Johnson)
Fig. 40. *Trypeta florescentiae* (Linnaeus)

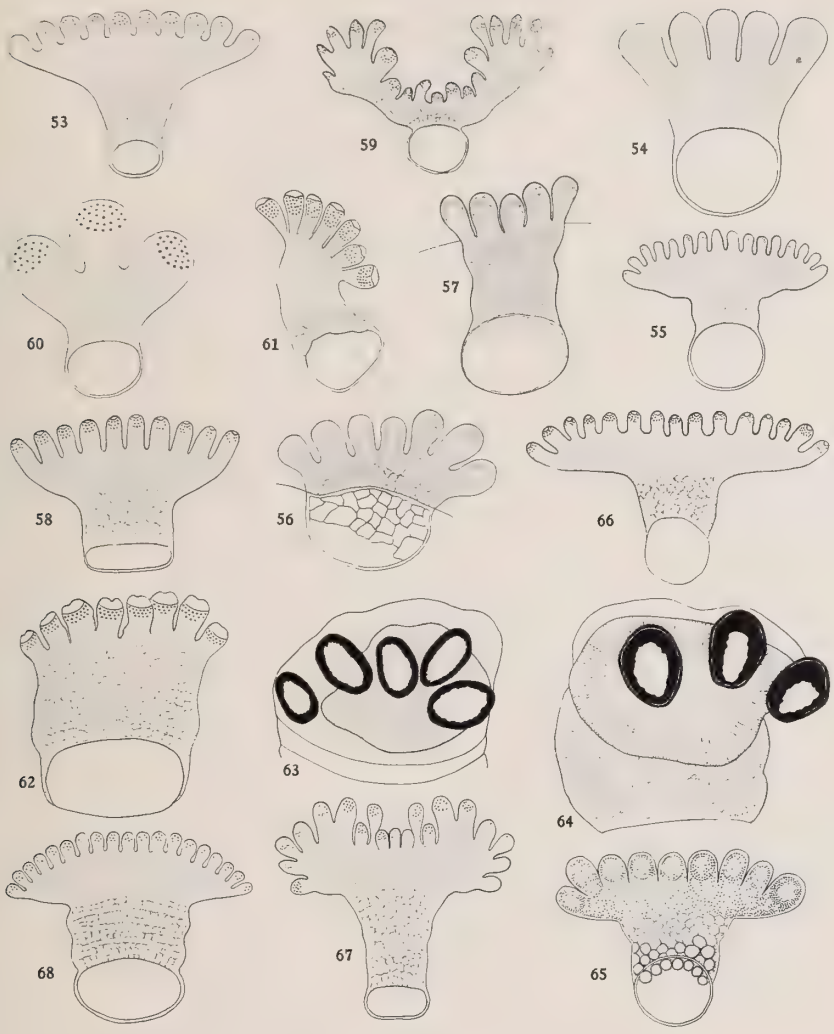


Cephalo-pharyngeal skeleton

Fig. 41. (?) *Trypeta palposa* Loew
Fig. 42. *Xanthaciura insecta* (Loew)
Fig. 43. *Zonosemata* sp.
Fig. 44. *Zonosemata electa* (Say)
Fig. 45. *Zonosemata setosa* (Doane)

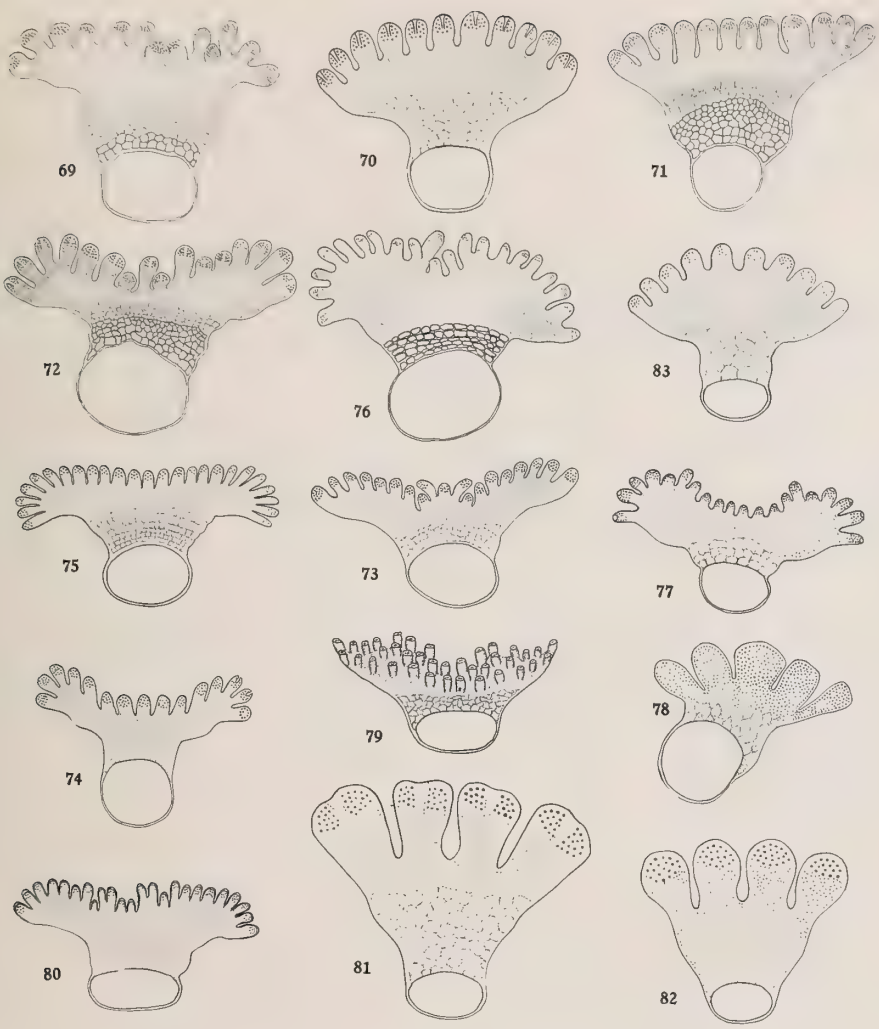
Anterior respiratory organs

Fig. 46. *Acidia fratria* Loew
Fig. 47. *Anastrepha ludens* (Loew)
Fig. 48. *Anastrepha pallens* Coquillett
Fig. 49. *Anastrepha serpentina* (Wiedemann)
Fig. 50. *Bactrocera cucurbitae* (Coquillett)
Fig. 51. *Dacus ferrugineus* (Fabricius)
Fig. 52. *Ceratitis capitata* (Wiedemann)



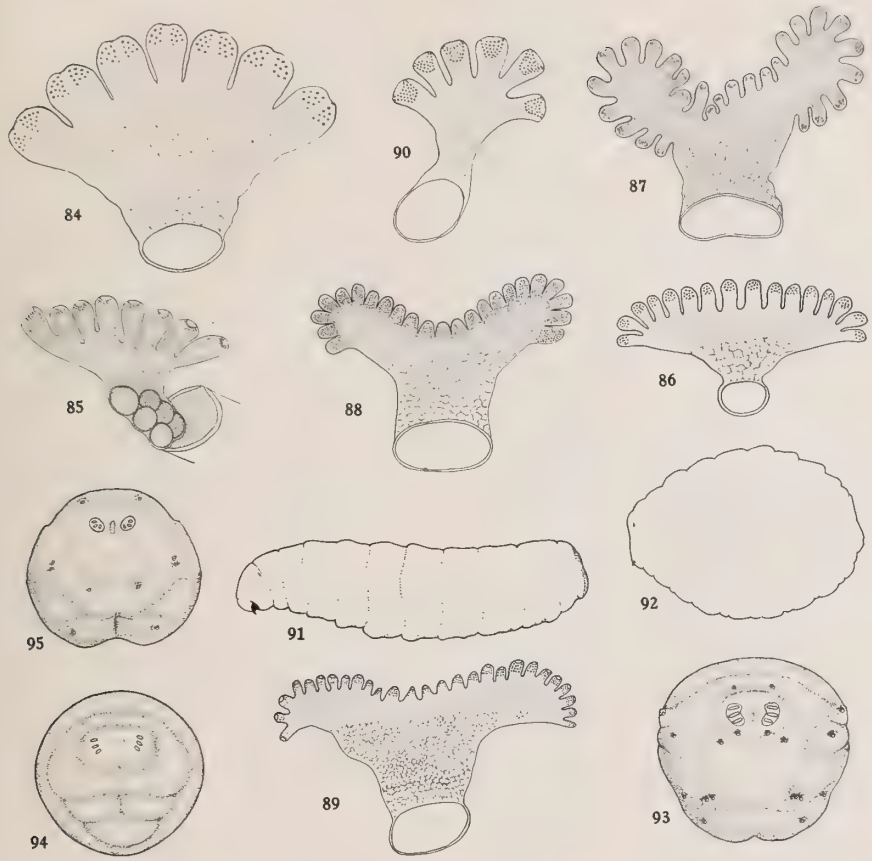
Anterior respiratory organs

Fig. 53. *Dacus oleae* (Rossi)
Fig. 54. *Paroxyna picciola* (Bigot)
Fig. 55. *Epochra canadensis* (Loew)
Fig. 56. *Eurosta comma* (Wiedemann)
Fig. 57. *Eurosta solidaginis* (Fitch)
Fig. 58. *Euaresta aequalis* (Loew)
Fig. 59. *Myoleja limata* (Coquillett)
Fig. 60. *Neaspilota achilleae* Johnson
Fig. 61. *Neaspilota albidipennis* (Loew)
Fig. 62. *Paracantha culta* (Wiedemann)
Fig. 63. *Procecidochares atra* (Loew)
Fig. 64. *Procecidochares australis* Aldrich
Fig. 65. *Rhagoletis berberis* Curran
Fig. 66. *Rhagoletis cerasi* (Linnaeus)
Fig. 67. *Rhagoletis cingulata* (Loew)
Fig. 68. *Rhagoletis fausta* (Osten Sacken)



Anterior respiratory organs

Fig. 69. *Rhagoletis indifferens* Curran
Fig. 70. *Rhagoletis juglandis* Cresson
Fig. 71. *Rhagoletis juniperinus* Marcovitch
Fig. 72. *Rhagoletis mendax* Curran
Fig. 73. *Rhagoletis pomonella* (Walsh)
Fig. 74. *Rhagoletis ribicola* Doane
Fig. 75. *Rhagoletis suavis* (Loew)
Fig. 76. *Rhagoletis completa* Cresson
Fig. 77. *Rhagoletis symphoricarpi* Curran
Fig. 78. *Tephritis finalis* (Loew)
Fig. 79. *Straussia longipennis* (Wiedemann)
Fig. 80. *Toxotrypana curvicauda* (Gerstaecker)
Fig. 81. *Trupanea abstersa* (Loew)
Fig. 82. *Trupanea actinobola* (Loew)
Fig. 83. *Trupanea jonesi* Curran



Anterior respiratory organs

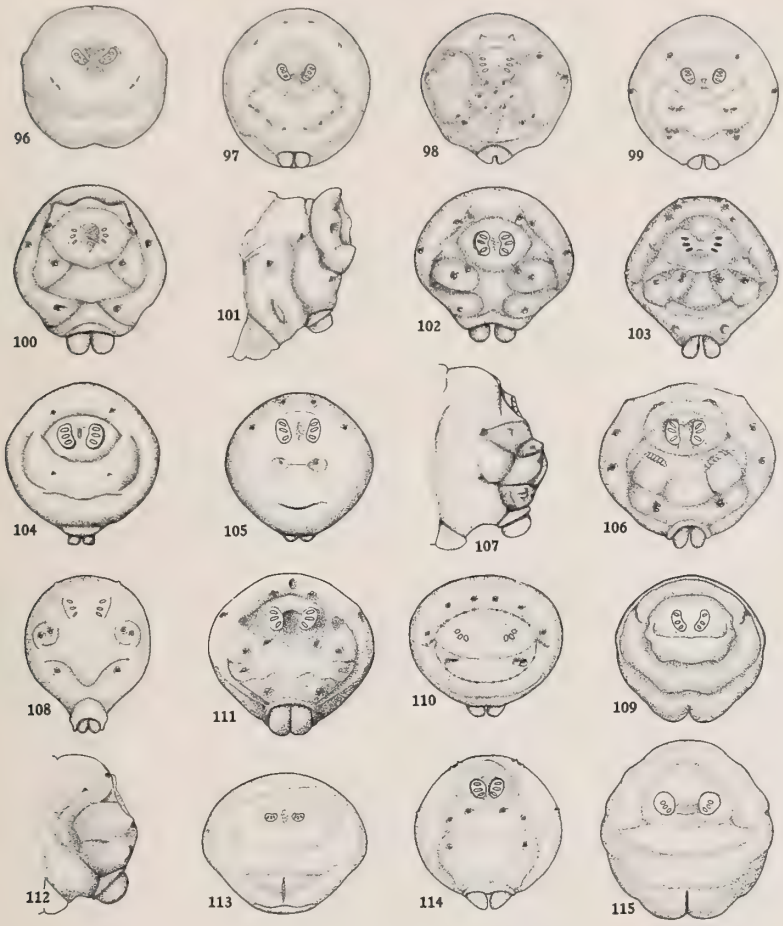
Fig. 84. *Trupanea subpura* (Johnson)
Fig. 85. *Trypeta florescentiae* (Linnaeus)
Fig. 86. (?) *Trypeta palposa* Loew.
Fig. 87. *Zonosemata setosa* (Doane)
Fig. 88. *Zonosemata* sp.
Fig. 89. *Zonosemata electa* (Say)
Fig. 90. *Xanthaciura insecta* (Loew)

Side view of entire larva

Fig. 91. *Trypeta florescentiae* (Linnaeus)
Fig. 92. *Eurosta comma* (Wiedemann)

Posterior view of caudal segment

Fig. 93. *Zonosemata electa* (Say)
Fig. 94. *Trupanea subpura* (Johnson)
Fig. 95. *Trypeta florescentiae* (Linnaeus)

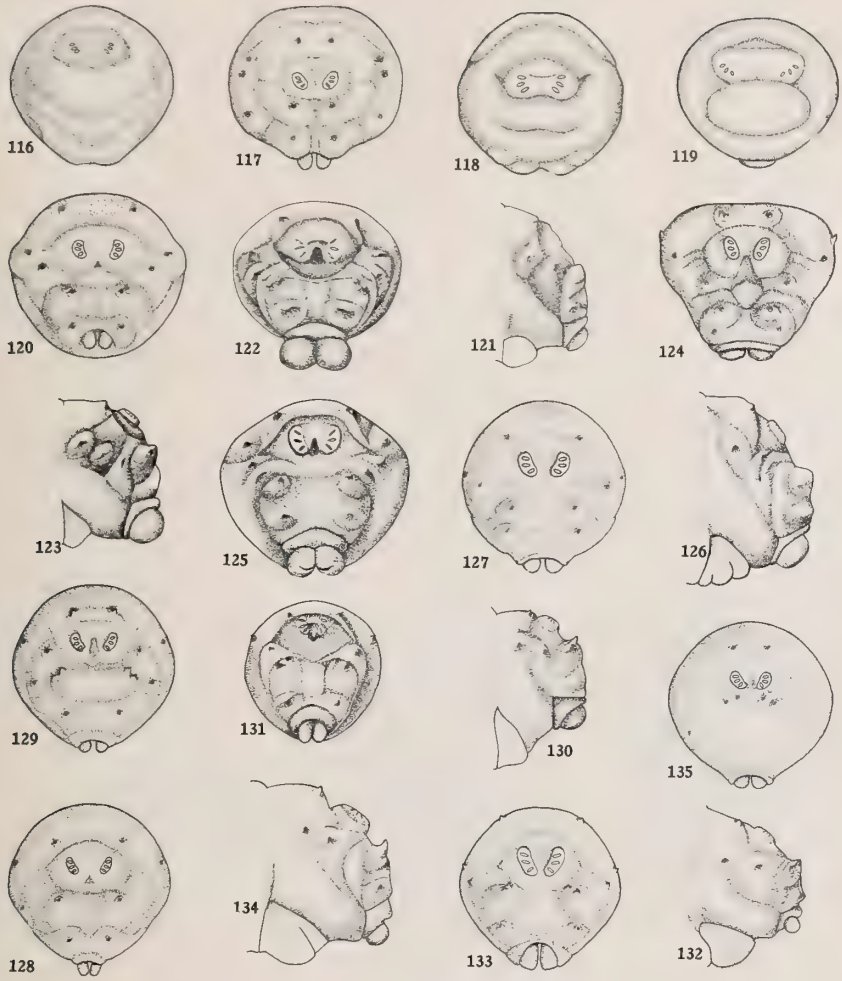


Posterior view of caudal segment

Fig. 96. *Xanthaciura insecta* (Loew)
Fig. 97. (?) *Trypeta palposa* Loew
Fig. 98. *Zonosemata* sp.
Fig. 99. *Zonosemata setosa* (Doane)
Fig. 100. *Acidia fratria* (Loew)
Fig. 102. *Anastrepha ludens* (Loew)
Fig. 103. *Anastrepha pallens* Coquillett
Fig. 104. *Anastrepha serpentina* (Wiedemann)
Fig. 105. *Bacirocera cucurbitae* (Coquillett)
Fig. 106. *Ceratitis capitata* (Wiedemann)
Fig. 108. *Dacus ferrugineus* (Fabricius)
Fig. 109. *Paroxyna picciola* (Bigot)
Fig. 110. *Euaresta aequalis* (Loew)
Fig. 111. *Epochra canadensis* (Loew)
Fig. 113. *Eurosta comma* (Wiedemann)
Fig. 114. *Myoleja limata* (Coquillett)
Fig. 115. *Eurosta solidaginis* (Fitch)

Profile of caudal segment

Fig. 101. *Acidia fratria* (Loew)
Fig. 107. *Ceratitis capitata* (Wiedemann)
Fig. 112. *Epochra canadensis* (Loew)



Posterior view of caudal segment

Fig. 116. *Neaspilota achilleae* Johnson
Fig. 117. *Neaspilota albidipennis* (Loew)
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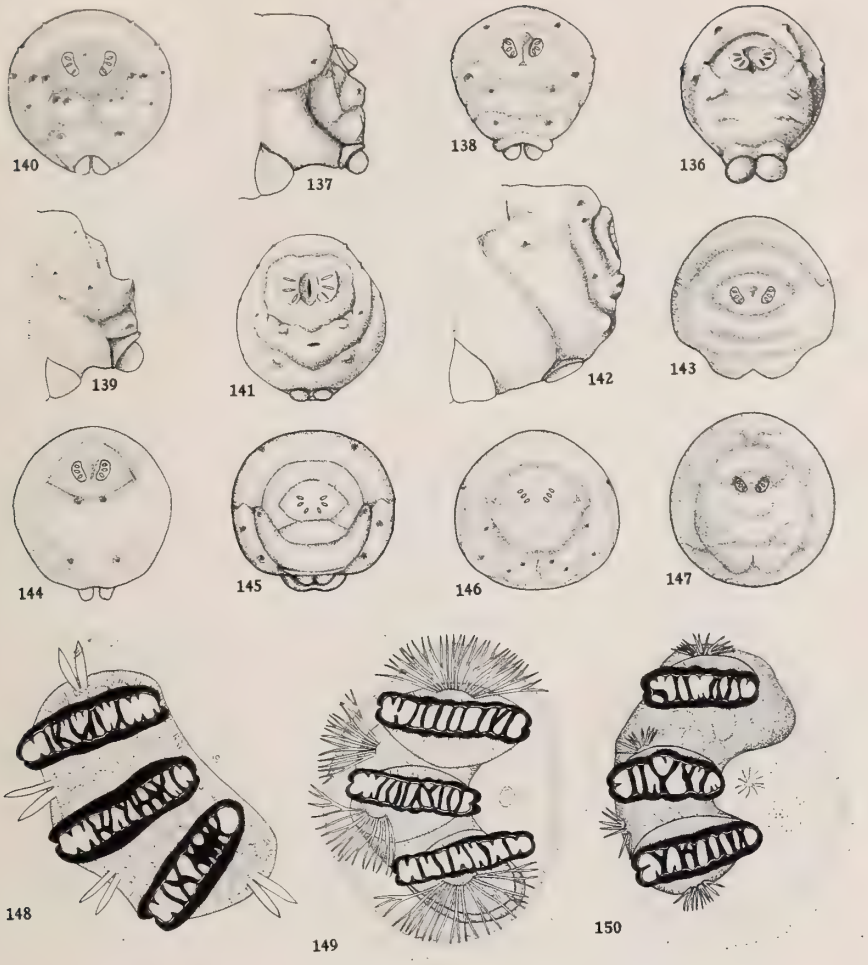
Fig. 122. *Rhagoletis cingulata* (Loew)
Fig. 124. *Rhagoletis cerasi* (Linnaeus)
Fig. 125. *Rhagoletis fausta* (Osten Sacken)
Fig. 127. *Rhagoletis indifferens* Curran
Fig. 128. *Rhagoletis juglandis* Cresson
Fig. 129. *Rhagoletis juniperinus* Marcovitch
Fig. 131. *Rhagoletis mendax* Curran
Fig. 133. *Rhagoletis pomonella* (Walsh)
Fig. 135. *Rhagoletis ribicola* Doane

Profile of caudal segment

Fig. 121. *Rhagoletis berberis* Curran
Fig. 123. *Rhagoletis cingulata* (Loew)
Fig. 126. *Rhagoletis fausta* (Osten Sacken)
Fig. 130. *Rhagoletis juniperinus* Marcovitch
Fig. 132. *Rhagoletis mendax* Curran
Fig. 134. *Rhagoletis pomonella* (Walsh)



Posterior view of caudal segment

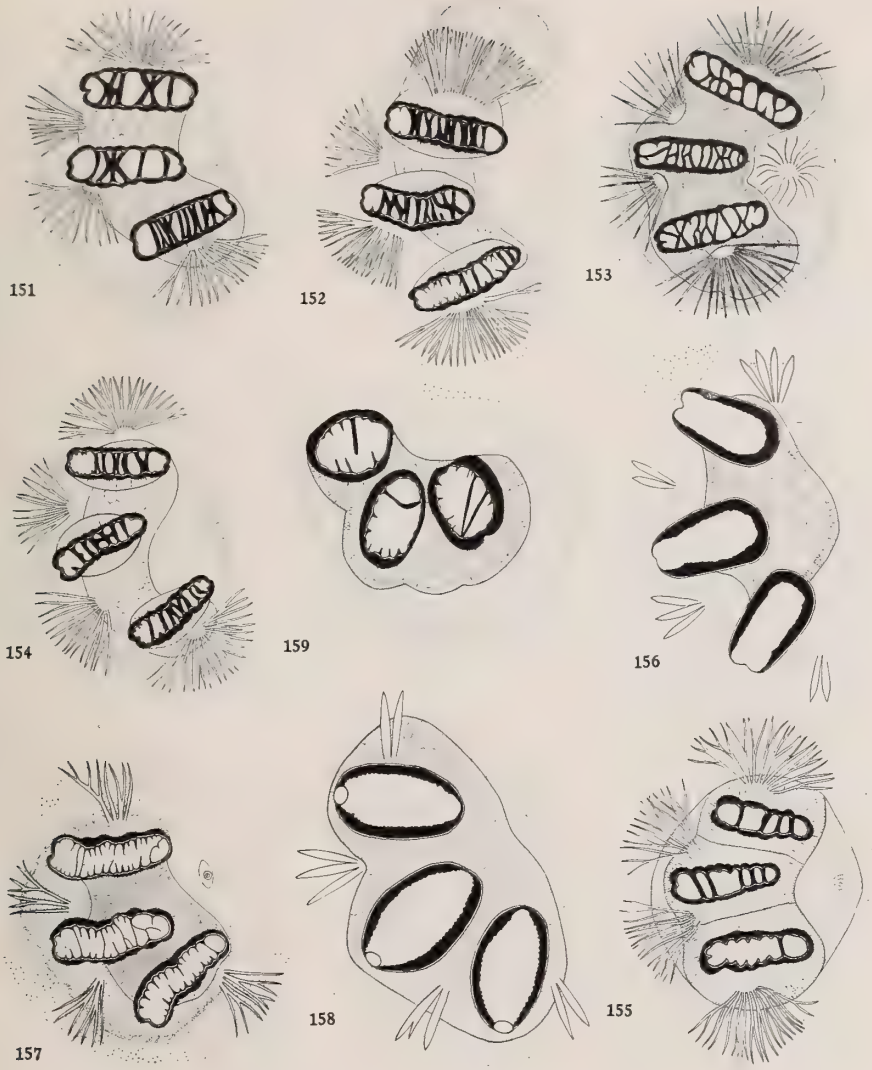
Fig. 136. *Rhagoletis suavis* (Loew)
Fig. 138. *Rhagoletis completa* Cresson
Fig. 140. *Rhagoletis symphoricarpi* Curran
Fig. 141. *Straussia longipennis* (Wiedemann)
Fig. 143. *Tephritis finalis* (Loew)
Fig. 144. *Toxotrypana curvicauda* (Gerstaecker)
Fig. 145. *Trupanea abstersa* (Loew)
Fig. 146. *Trupanea actinobola* (Loew)
Fig. 147. *Trupanea jonesi* Curran

Profile of caudal segment

Fig. 137. *Rhagoletis suavis* (Loew)
Fig. 139. *Rhagoletis completa* Cresson
Fig. 142. *Straussia longipennis* (Wiedemann)

Posterior respiratory organs

Fig. 148. *Acidia fratria* (Loew)
Fig. 149. *Anastrepha ludens* (Loew)
Fig. 150. *Anastrepha pallens* Coquillett

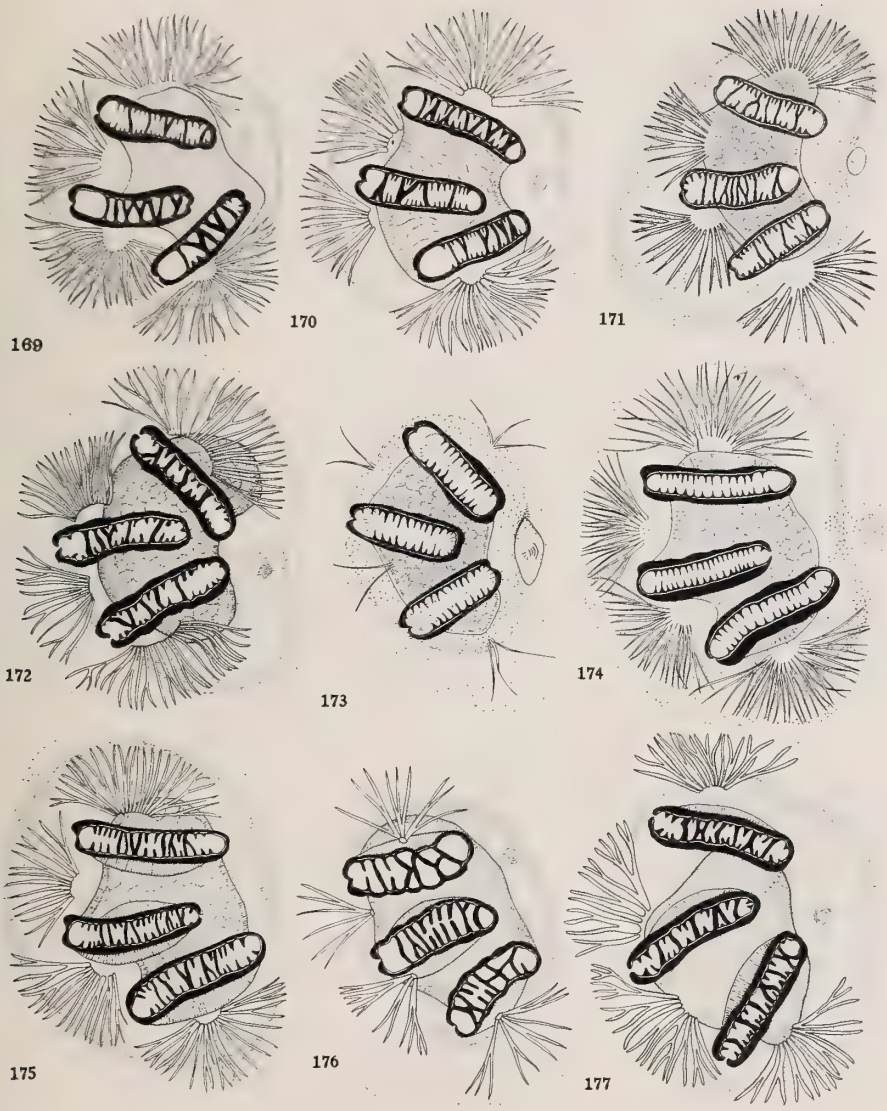


Posterior respiratory organs

Fig. 151. *Anastrepha serpentina* (Wiedemann)
Fig. 152. *Bactrocera cucurbitae* (Coquillett)
Fig. 153. *Ceratitis capitata* (Wiedemann)
Fig. 154. *Dacus ferrugineus* (Fabricius)
Fig. 155. *Dacus oleae* (Rossi)
Fig. 156. *Paroxyna picciola* (Bigot)
Fig. 157. *Epochra canadensis* (Loew)
Fig. 158. *Euaresta aequalis* (Loew)
Fig. 159. *Eurosta comma* (Wiedemann)

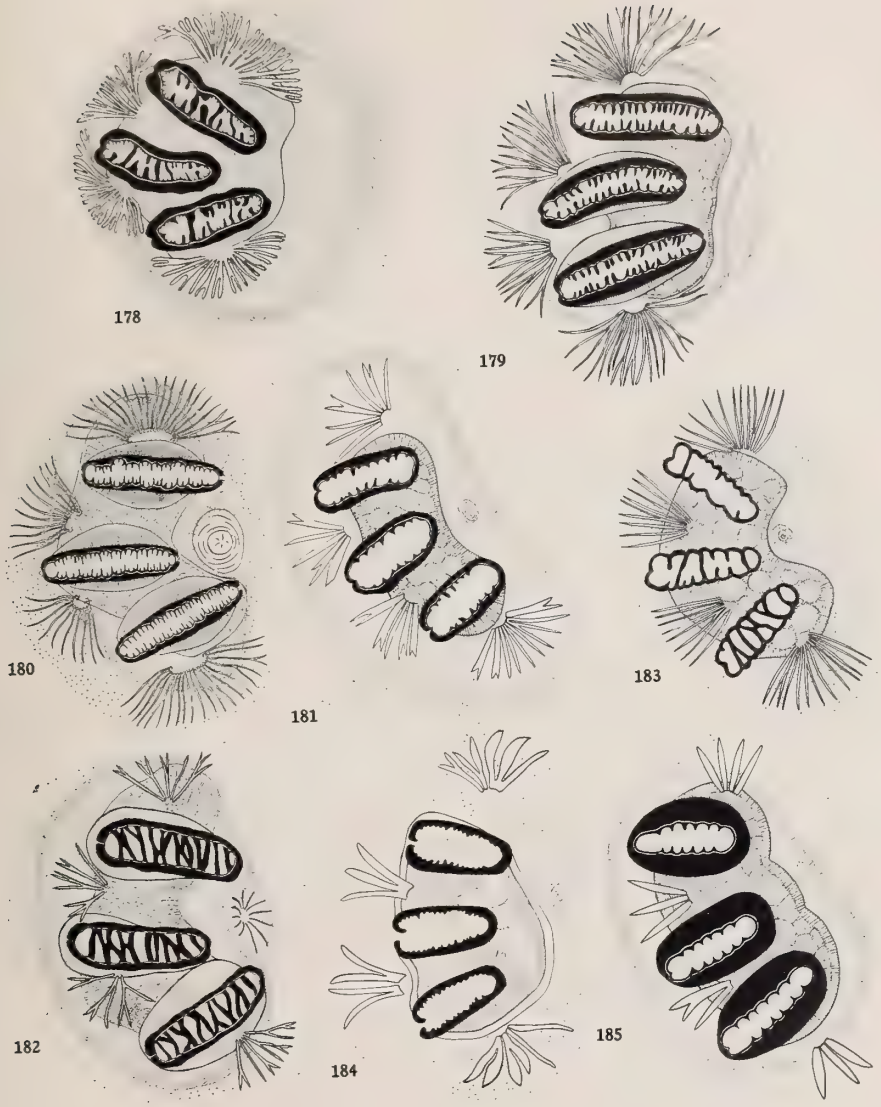
Posterior respiratory organs

Fig. 160. *Eurosta solidaginis* (Fitch)
Fig. 161. *Myoleja limata* (Coquillett)
Fig. 162. *Neaspilota achilleae* Johnson
Fig. 163. *Neaspilota albidipennis* (Loew)
Fig. 164. *Paracantha culta* (Wiedemann)
Fig. 165. *Procecidochares atra* (Loew)
Fig. 166. *Procecidochares australis* Aldrich
Fig. 167. *Rhagoletis berberis* Curran
Fig. 168. *Rhagoletis cerasi* (Linnaeus)



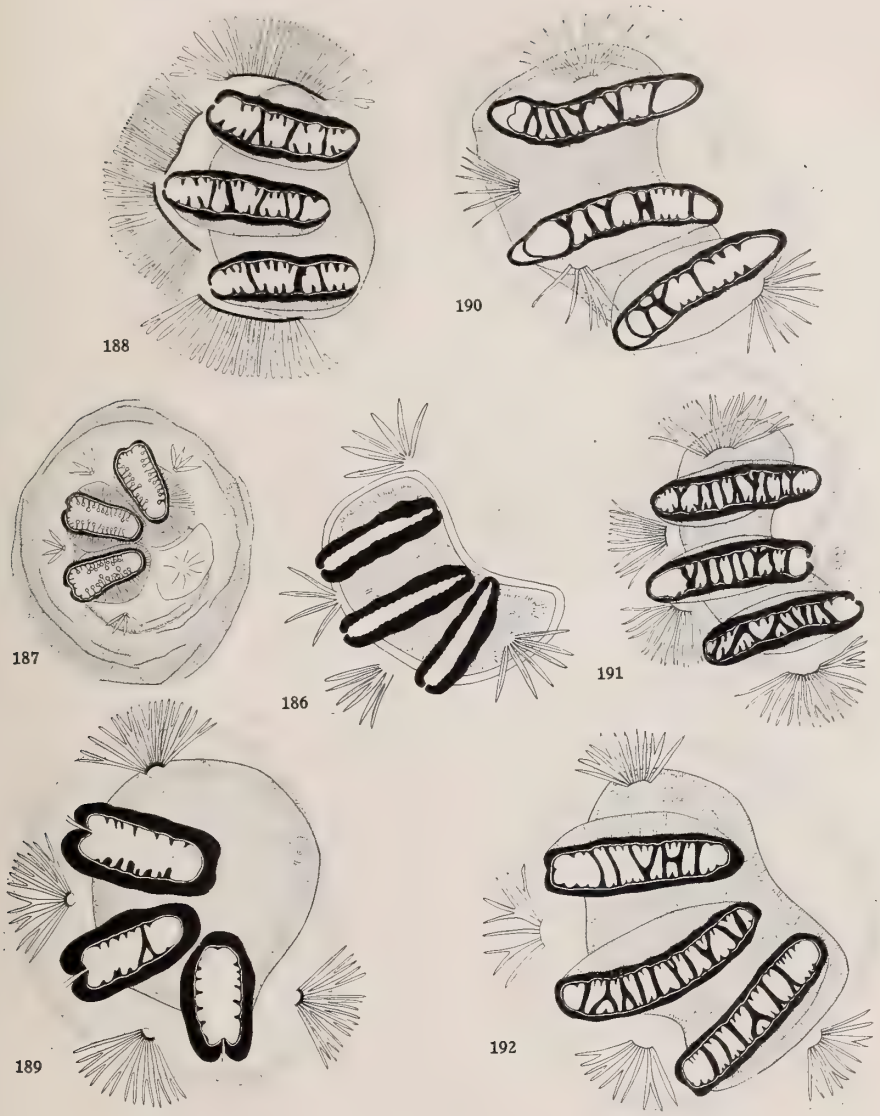
Posterior respiratory organs

Fig. 169. *Rhagoletis cingulata* (Loew)
Fig. 170. *Rhagoletis fausta* (Osten Sacken)
Fig. 171. *Rhagoletis indifferens* Curran
Fig. 172. *Rhagoletis juglandis* Cresson
Fig. 173. *Rhagoletis juniperinus* Marcovitch
Fig. 174. *Rhagoletis mendax* Curran
Fig. 175. *Rhagoletis pomonella* (Walsh)
Fig. 176. *Rhagoletis ribicola* Doane
Fig. 177. *Rhagoletis suavis* (Loew)



Posterior respiratory organs

Fig. 178. *Rhagoletis completa* Cresson
Fig. 179. *Rhagoletis symphoricarpi* Curran
Fig. 180. *Straussia longipennis* (Wiedemann)
Fig. 181. *Tephritis finalis* (Loew)
Fig. 182. *Toxotrypana curvicauda* (Gerstaecker)
Fig. 183. *Trupanea abstersa* (Loew)
Fig. 184. *Trupanea actinobola* (Loew)
Fig. 185. *Trupanea jonesi* Curran



Posterior respiratory organs

Fig. 186. *Trupanea subpura* (Johnson)
Fig. 187. *Trypeta florescentiae* (Linnaeus)
Fig. 188. (?) *Trypeta palposa* Loew
Fig. 189. *Xanthaciura insecta* (Loew)
Fig. 190. *Zonosemata* sp.
Fig. 191. *Zonosemata electa* (Say)
Fig. 192. *Zonosemata setosa* (Doane)

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